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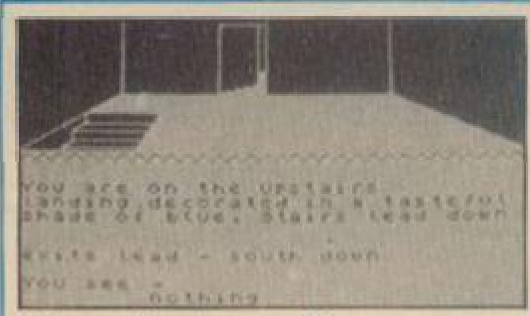
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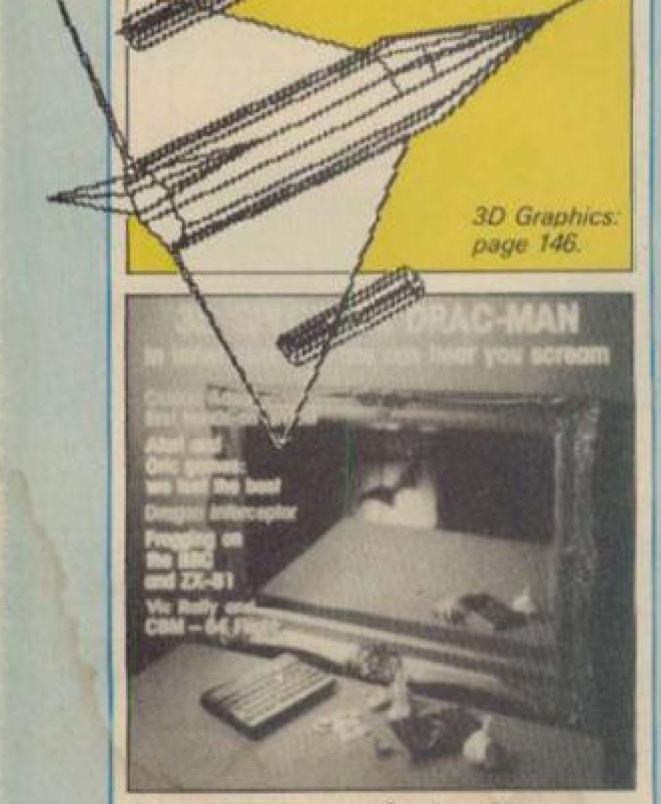
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Oric Software: page 64



Draw routine: page 107



3D Graphics: page 146.

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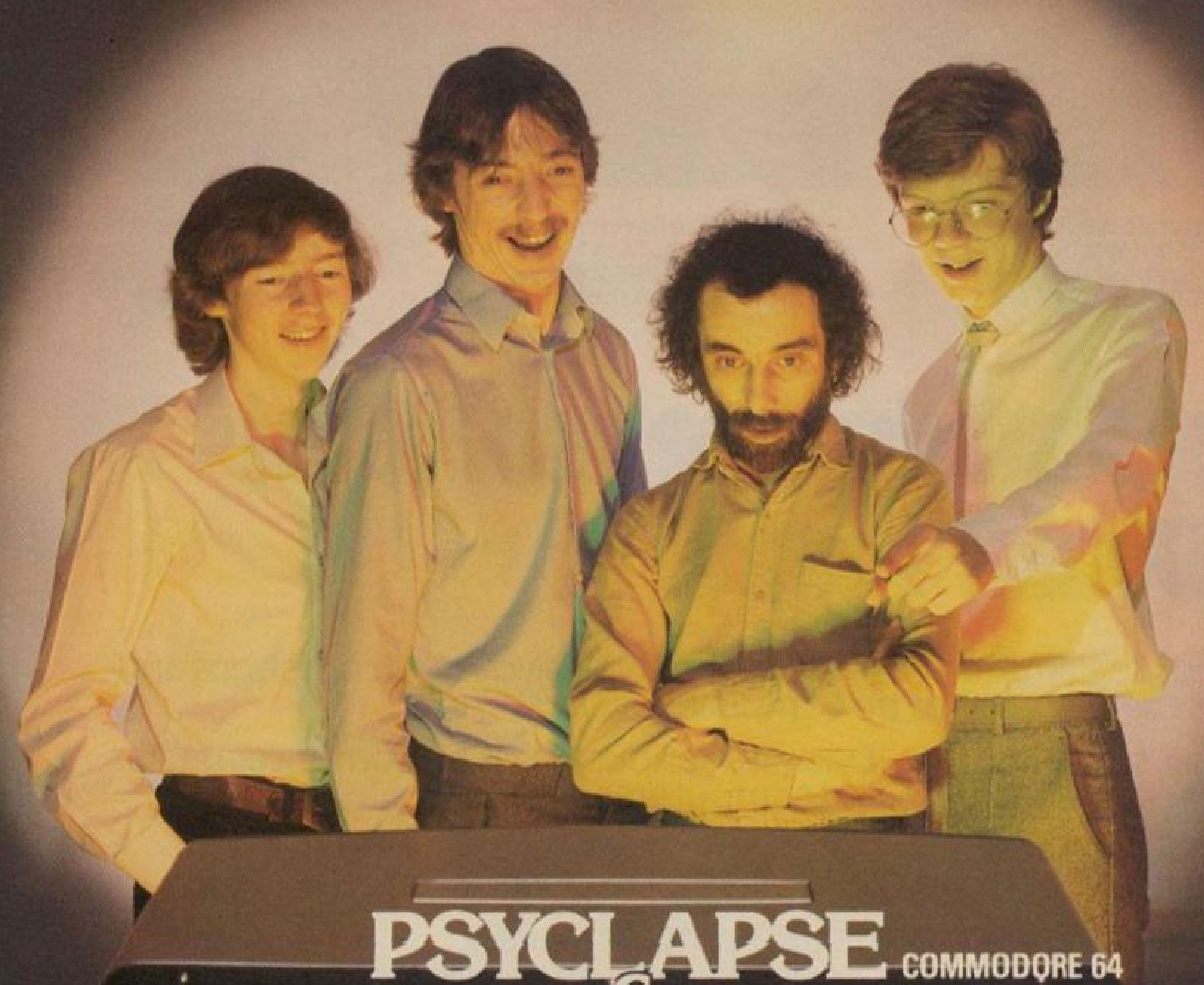
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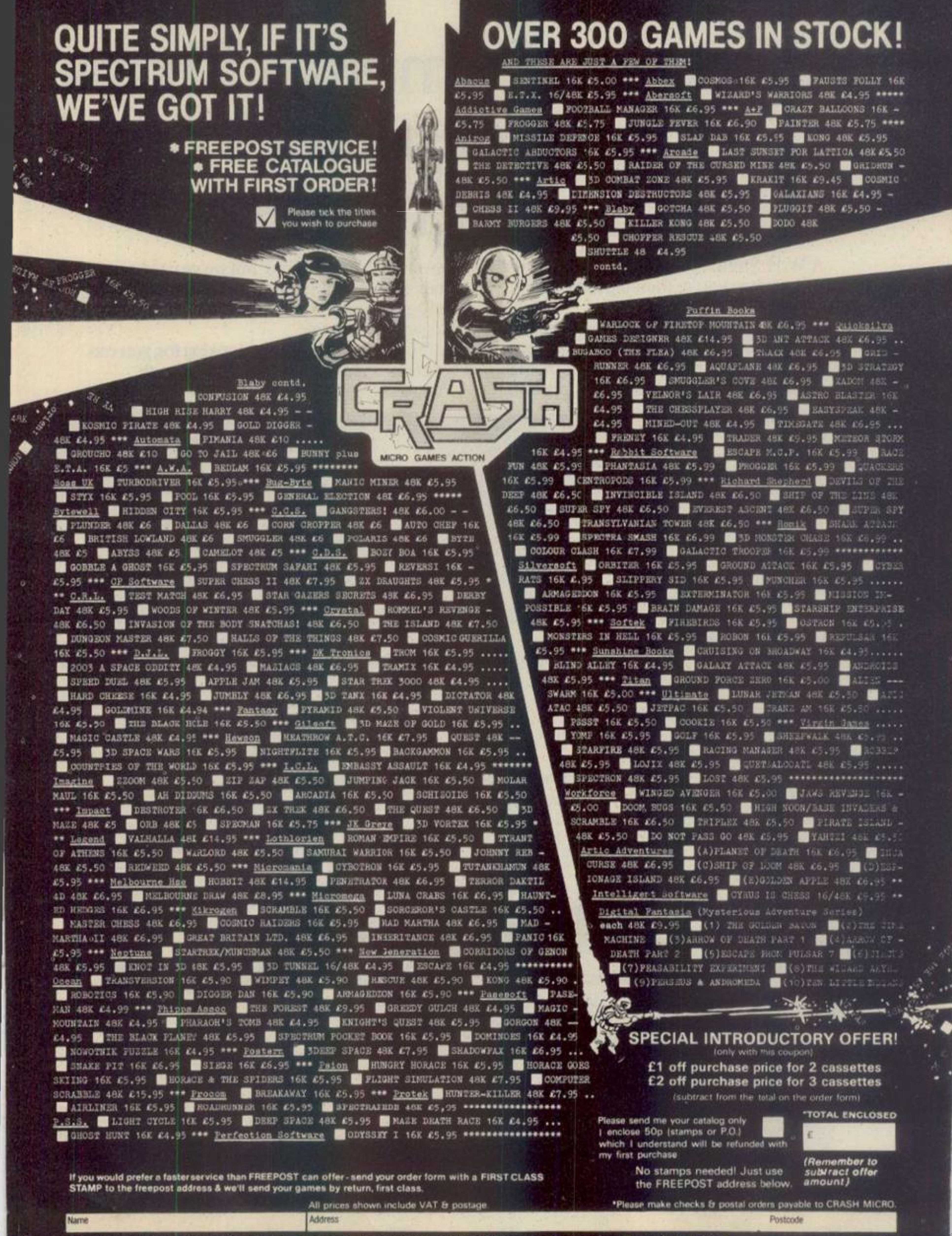
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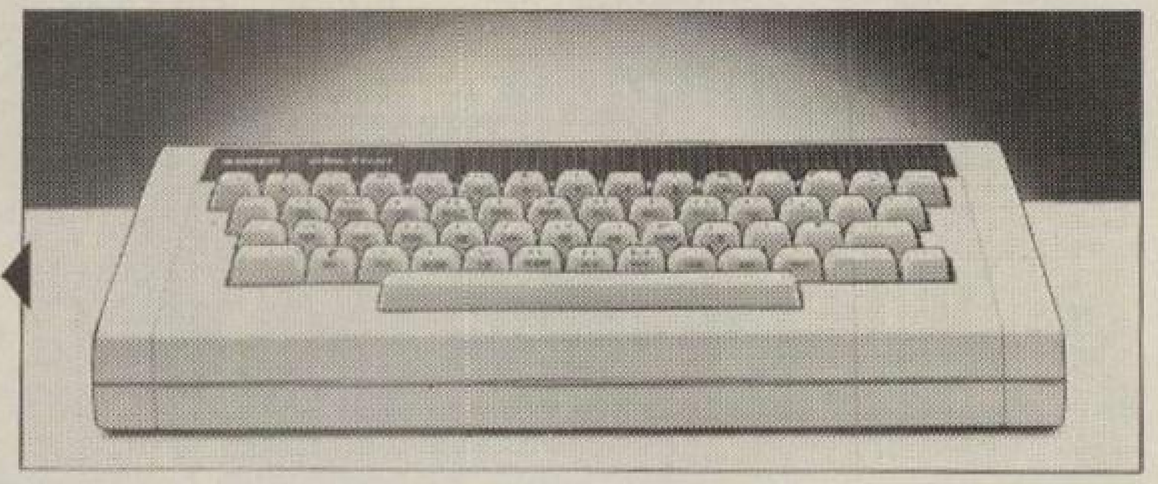
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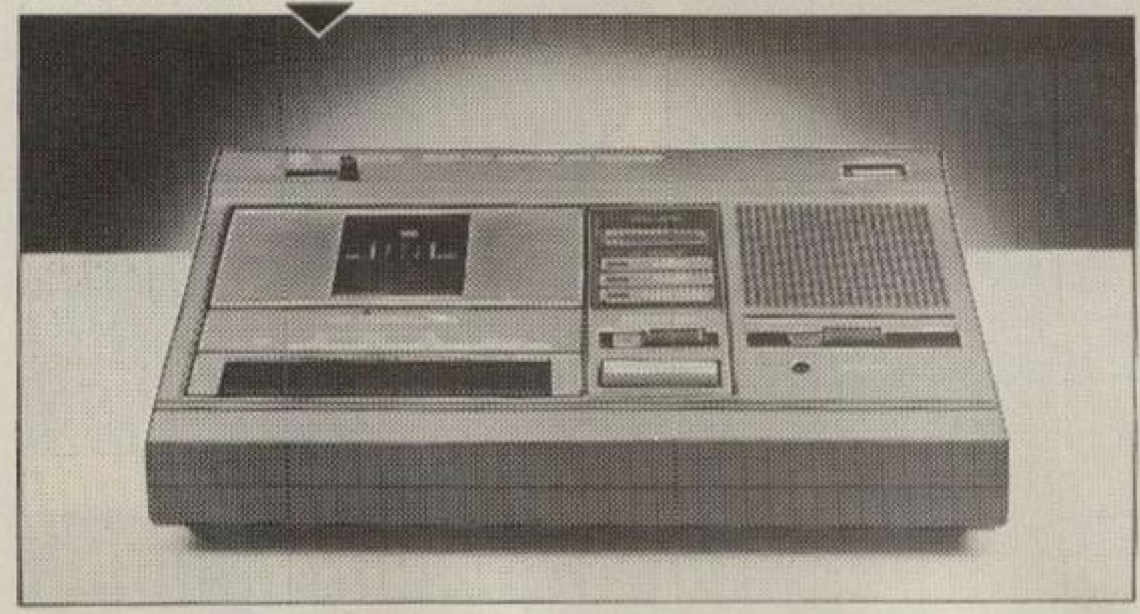
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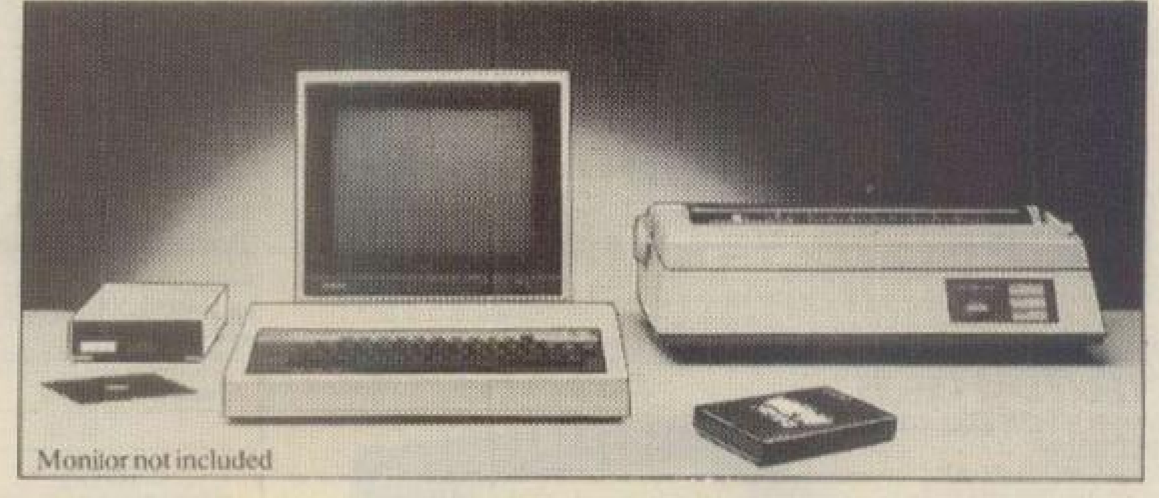
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For the Spectrum, The VIC-20, The Jupiter Ace and the ZX-81

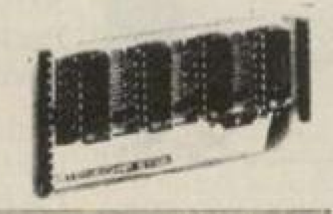


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MORE MEMORY FOR YOUR JUPITER ACE

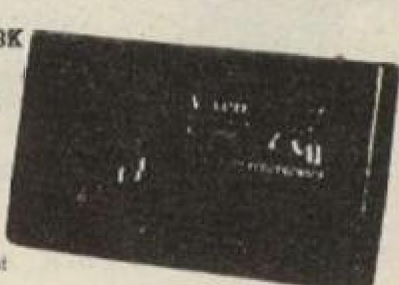
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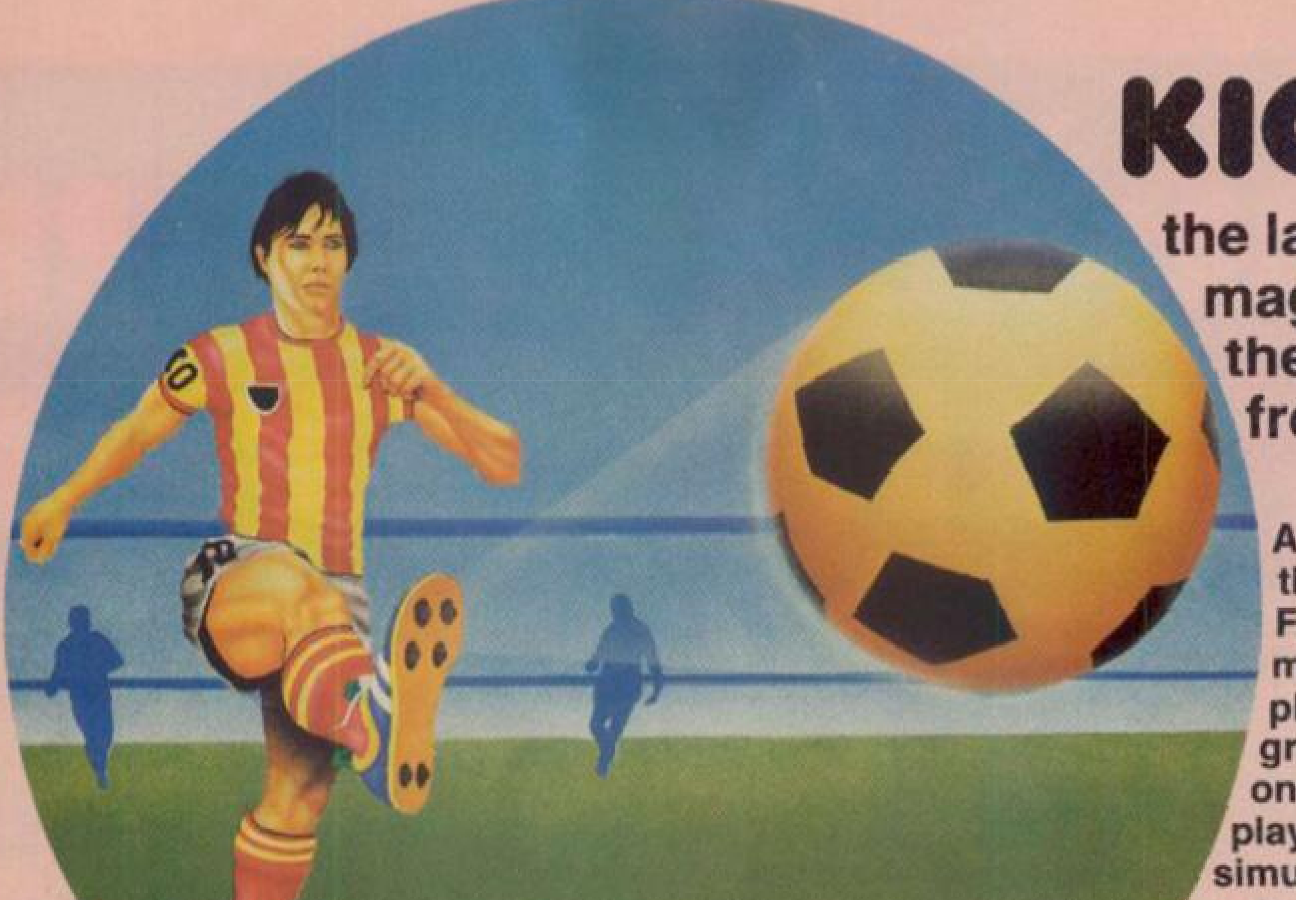
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the latest in the line of magical programs for the Commodore 64 from bubble bus

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New



WIDOWS REVENGE

Similar to our 'Best Seller' Exterminator, but this game fires back! Obliterate *all of the* Widows Warriors but watch out for Photon Webbs and devious Egg Layers. Machine code.

HUSTLER

Written in machine code and using Sprite graphics HUSTLER takes the 64 to its limits. There are six 'pool' type games for one or two players, high scores kept and super music. Machine code. See the great press reviews. You won't find a more realistic snooker type game.

"Another gem – a must for the collection"
Commodore Computing

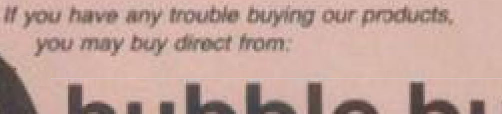
EXTERMINATOR

Definitely one of the best arcade action games around for the 64. Shoot the worm and everything else in the garden whilst avoiding the deadly spider and swooping eagle. Machine code using high resolution and Sprite graphics with excellent sound. Beware, it's very addictive.

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The Electron and Carto

Pack up your paintbox, throw away your paintbrushes and move into the electronic age of art with our amazing new PIXSTIK™

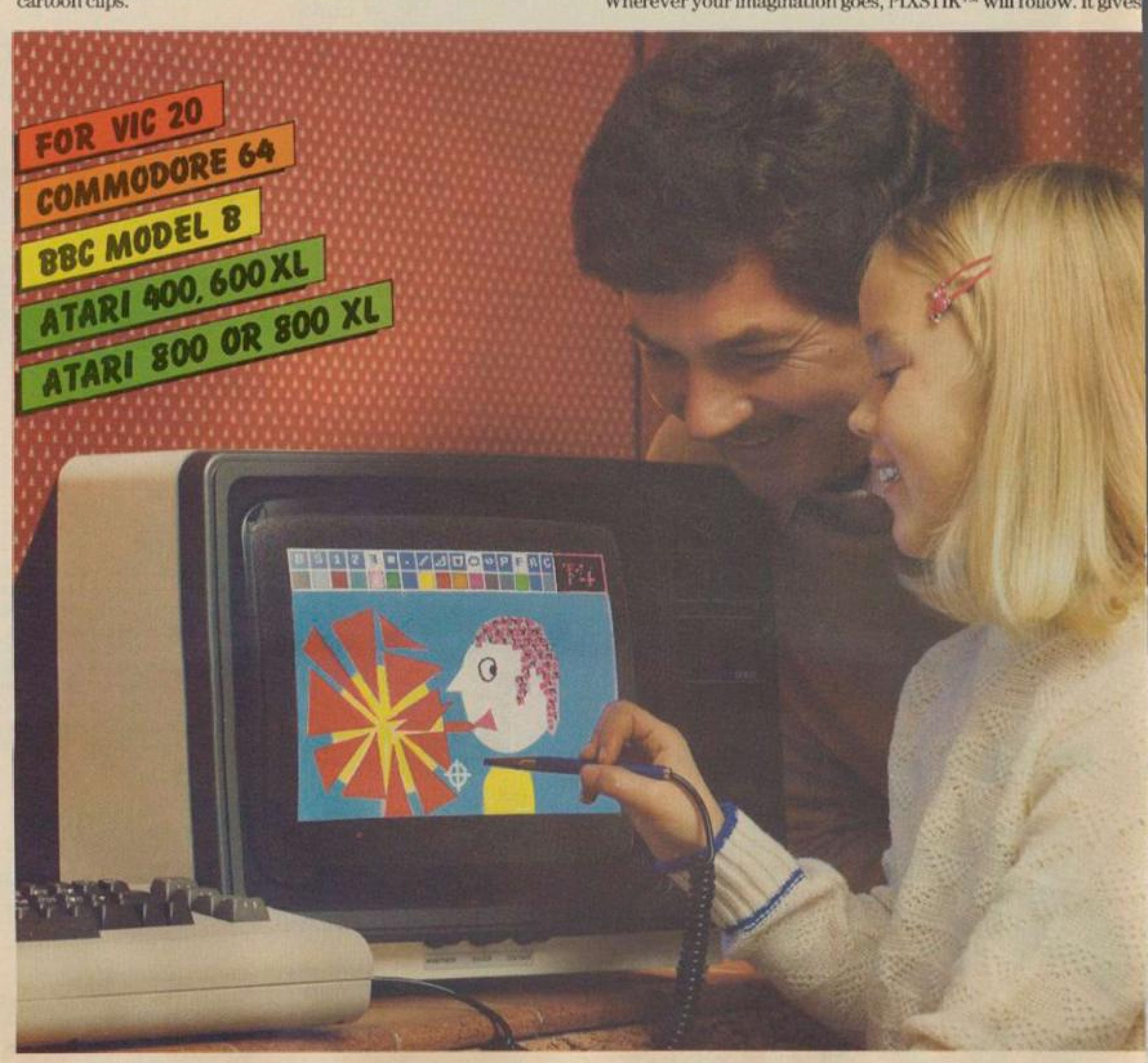
PIXSTIK™ opens the way for all the family to create colourful designs and pictures – yet it's so much cleaner and simpler to use than conventional crayons and paints. Plus you have the built-in advantage of the exclusive ABC feature. ABC stands for animate, bounce and cartoon, meaning you can even add movements to your sketches and drawings. It's just like creating your very own cartoon clips.

With PIXSTIK™, the colours never run dry and you don't have to worry about paper supplies.

You just plug in and all the materials you need are listed on the screen. You'll have access to up to 16 exciting colours and 16 separate commands. Simply give your instructions by pointing PIXSTIK™ at the appropriate colour or command.

PIXSTIK™ couldn't be easier to operate. Whether you're eight or eighty, you'll find it fascinating, especially when you discover the range of pictures you can produce.

Wherever your imagination goes, PIXSTIK™ will follow. It gives





There is no limit to the wonderful artistic creations you can produce with a PIXSTIK™ and special PAINTBOX Software – here are just a few examples of its infinite possibilities.

you freehand freedom or creates straight lines, triangles, rectangles, circles and ellipses with geometrical precision.

Choose whether to fill your shapes with solid colour or leave them blank. And if, after that, you still favour a paintbrush effect, simply move PIXSTIK™ into paintbrush mode and it will do the rest.

What makes PIXSTIK™ even more special is that it doesn't simply stop with a completed picture. Because it incorporates the special ABC feature, you can use individual designs as part of animated sequences and cartoons.

At the "animate" command, pictures stored in memory will reappear in turn. On the "bounce" instruction, your pictures will move forwards and backwards and when "cartoon" is called up, they will reappear continuously in sequence with just the effect of a professional cartoon clip.



Pictures can be drawn using fine lines, blocked lines or paintbrush effects for extra variety.

PIXSTIK™ can bring all your pictures to life. Use it to show the sun moving across the sky, smoke curling from a chimney and an arrow hitting its target.

The only limit on PIXSTIK™ designs is your own inventiveness. There are even three different stick modes to ensure different colours can be drawn across each other without merging.



For only £29.95, the PIXSTIK™ pack includes *three* superb computer games to play with your stick, plus a comprehensive instruction manual.

No paintbox could ever offer so much.
So swap your paintbrush for a PIXSTIK™ today.
It's the paintbox of the future.



PIXSTIK™ is available by mail order only, exclusively from Computapix Ltd., Gores Road, Kirkby Industrial Estate, Liverpool. Dealers: Contact Selena on 051-547 2741

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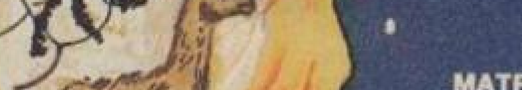
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A fast and original game for the unexpanded VIC. Challenging and colourful, with good sonics and a unique game action and design, this promises to be the most exciting new 3.5K VIC game since the introduction of GRIDRUNNER nearly a year ago.

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MATRIX

Jeff Minter has taken Gridrunner – the game that topped bestseller charts in USA and UK – and created an awesome sequel.

Graphically superb, it features multiple screens, new aliens and attack waves, mystery bonuses, renegade humanoids, deflexor fields, diagonal tracking, countdown/panic phase and much, much more . . . Packed into 20 mind-zapping zones and accompanied by incredible sonics.

8K expansion required.

Available for Commodore 64 £7.50 and VIC-20 £6.



HOVER BOVVER

A totally original arcade game for C64 featuring outstanding graphics and a sound track created by a professional Piano Wizard. Gordon Bennet has borrowed his neighbour's Air-Mo lawnmower. Mow your way through as many of the 16 lawns as you can before the pursuing neighbour retrieves his mower. Set your dog onto the neighbour to help you out of tight spots and don't annoy the gardener. Try not to plough through the neat flower beds or overheat your mower!

£7.50



ATTACK of the MUTANT CAMELS

Planet earth needs you! Hostile aliens have used genetic engineering to mutate camels from normally harmless beasts into 90 foot high, neutronium shielded, laser-spitting death camels!! Can you fly your tiny, manoeuvrable fighter over the mountainous landscape to weaken and destroy the camels before they invade the humans stronghold! You must withstand withering laser fire and alien UFOs. Game action stretches over 10 screen lengths and features superb scrolling, scanner 1/2 player actions and unbelievable animation! Play this game and you'll never be able to visit a zoo again without getting an itchy trigger finger! Awesome m/c action!

Available for Commodore 64 £7.50.



REVENGE OF THE MUTANT CAMELS

At last the long awaited sequel to Attack of the Mutant Camels is available. You are controlling a ninety foot high, neutronium shielded, lazer spitting death camel; leading a rebellion against your evil Zzyaxian overlords. The game features beautiful smooth scrolling graphics and no less than 42 different attack waves, more than any game in video history. The challenge of play will last for months as you battle to see what's on the next wave.



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Finally true arcade quality on the unexpanded VIC! Shoot down the segmented DROIDS invading the grid. Beware of the pods and zappers! The awesome speed, sound and graphics gives you the best blast available for unexpanded VIC.

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Not all home computers stay at home.

The BBC Micro is the ideal family computer–simple to operate, yet fast, powerful, with enormous potential.

But it's nice to know, when you buy one for your home, that the business, educational and scientific worlds agree with your choice.

Here are a few stories to illustrate how the BBC Micro gets out and about. And one to remind you how helpful it can be when it stays at home.

A practical lesson in business admin.

The contribution of the BBC Micro in the classroom has long been recognised at Perins Community School in Hampshire.

The School has 12 BBC Micros used extensively across the syllabus: in fact some pupils are using them to study for their GCE O Levels in computing.

One of the programs available to Perins teachers such as David Beck, pictured below with his class, is "Newsagent."

This program contains all the necessary information for the class to run a newsagent's shop; allowing them to organise daily deliveries, make up bills and keep an eye on stock control and ordering.

It's a nice example of how the BBC Micro can be used not only to acquaint a class with the language of computers, but also with some of the realities of the community in which they live.

Correcting Jodrell Bank.

The BBC Micro is a familiar worker around Jodrell Bank.

You'll find it in the reception area explaining the workings of a radio telescope to visitors, for example.

But it's also been helping in a more testing task: to improve the performance of the Defford telescope.

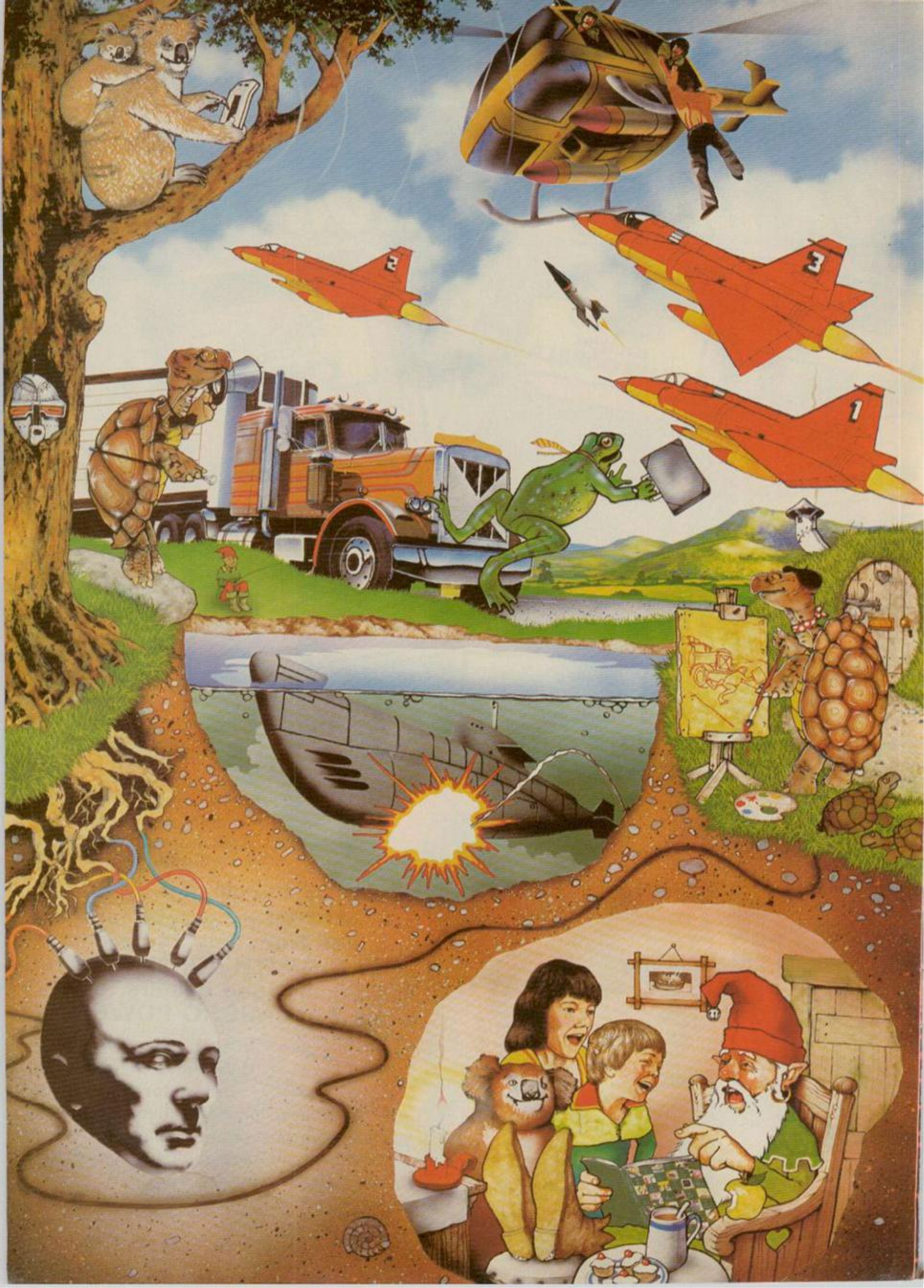
In this application it has been used to make calculations necessary to determine the precise parabolic shape of the dish.

Theodolites are used to do the measuring–then the BBC Micro works out the necessary corrections.


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2. Frogger *by Sierra On-Line.*

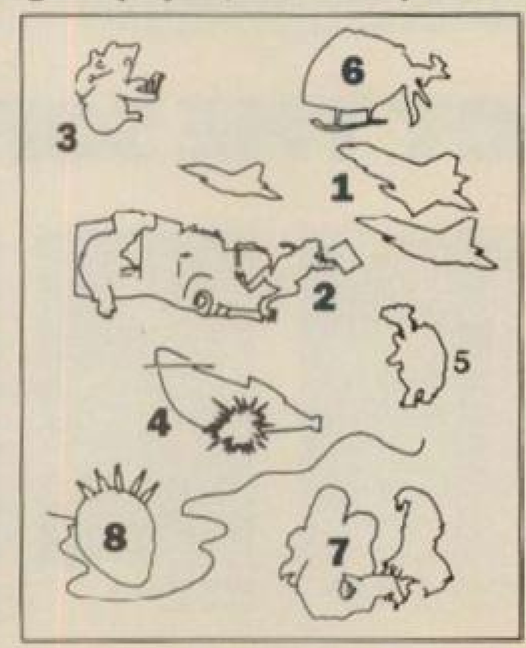
Now you're a frog stranded a long way from home. A perilous journey awaits you. Once across the busy motorway, a surging river full of logs, turtles and alligators awaits. Better flex those Froggy leg-muscles though, the bank is steep, so look before you leap!

3. KoalaPad Touch Tablet *by Koala.*

You can't overfeed this Koala — he'll make his own menu selections. He'll also move game players, make musical notes, draw computer graphics and much more. The KoalaPad Touch Tablet is an accessory that'll enhance the capabilities of your home computer system.

4. Sea Dragon *by Adventure International.*

Take a deep breath — you'll need it to navigate your sub through a labyrinthian underwater passage to free the menace of the imprisoned Sea Dragon. Mines, electrifying eels and lethal laser beams await you in this murky underwater world. You've limitless torpedoes, but limited air, so hurry!



5. Turtle Graphics II *by HesWare.*

This Turtle's about to paint the town red. Or green. Or blue with pink spots. By teaching him to paint, draw and colour he'll teach you, painlessly and enjoyably, the basics of computer programming — maths, logic, communications and more with over sixty commands. Ideal for children from six to sixty.

6. Choplifter *by Broderbund.*

Sixteen hostages are holed up in an inaccessible barracks. Only an ace chopper pilot can free them — you!

Watch out for the tanks, they'll crush anything. They're just for starters — fighter jets and the awesome homing air-mines are yet to come. Good luck . . . you'll need it!

7. Kids and the Apple/Atari *by Datamost.*

These books will teach you, simply, how to write your own programmes. Step-by-step instructions teach you how to create your own action, board and word games. Programme your finances or even learn another language — whatever you do, you'll get the most out of your home computer.

8. Suspended *by Infocom.*

20 miles beneath the earth's surface your brain is wired to a computer network. You'll strategically manipulate 6 robots to overcome a myriad of realistic and original problems as you try to maintain surface-side equilibrium. But don't worry, the end is in sight — you're only there for 500 years!

Phew, back to earth! Now beam yourself over to your local dealer and check out his software. He's got just about everything, we should know, we supply it.



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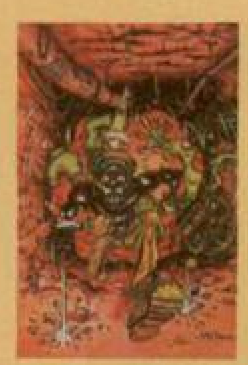
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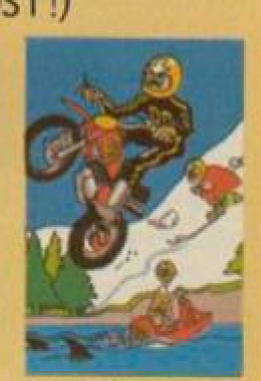
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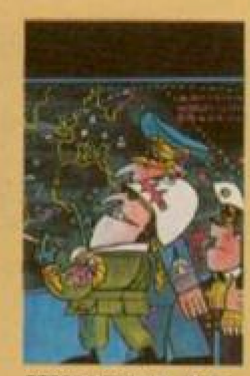
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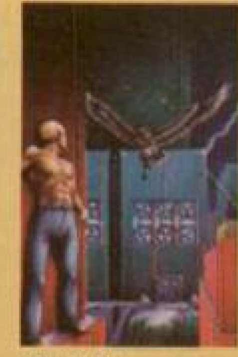
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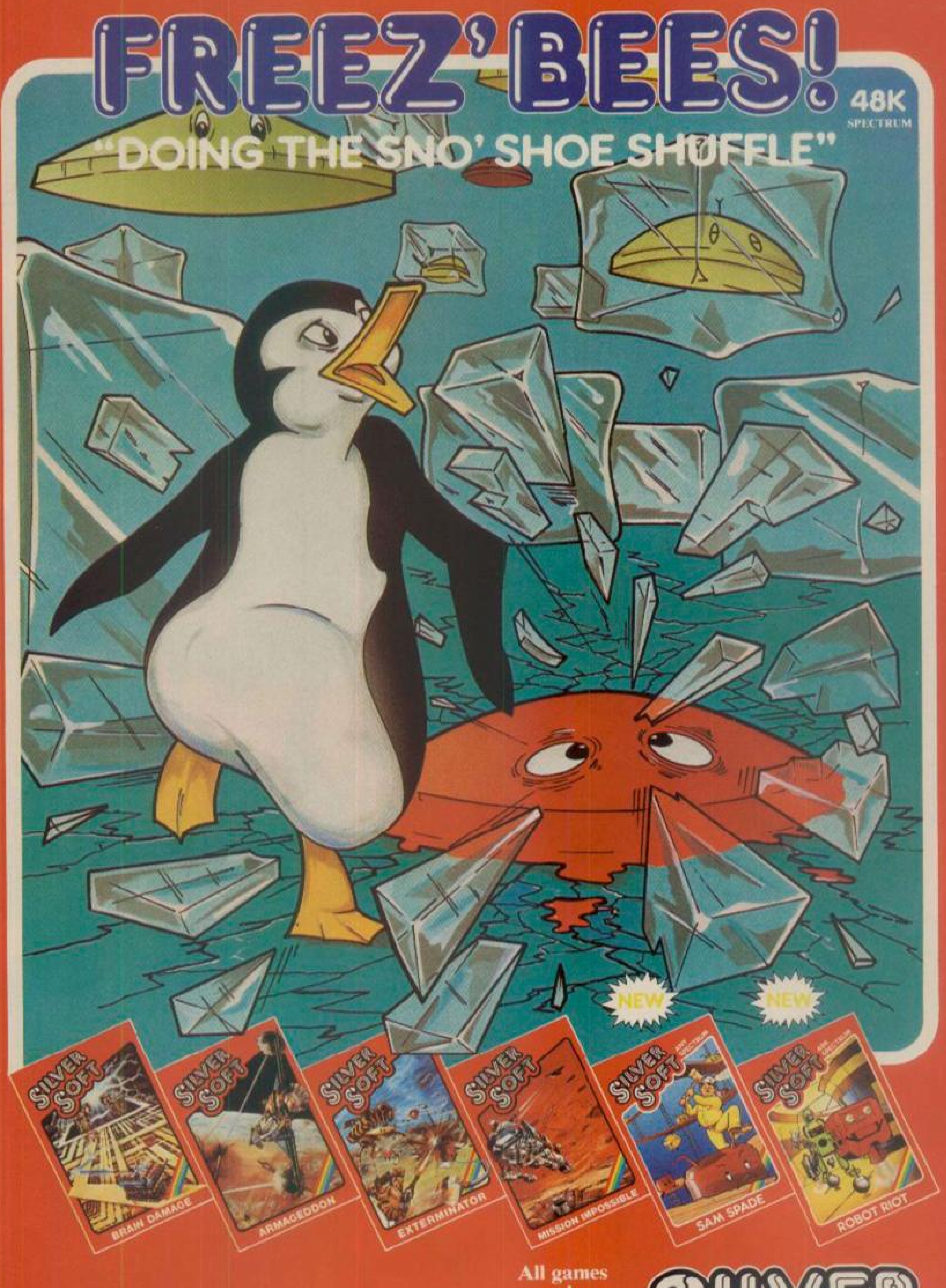


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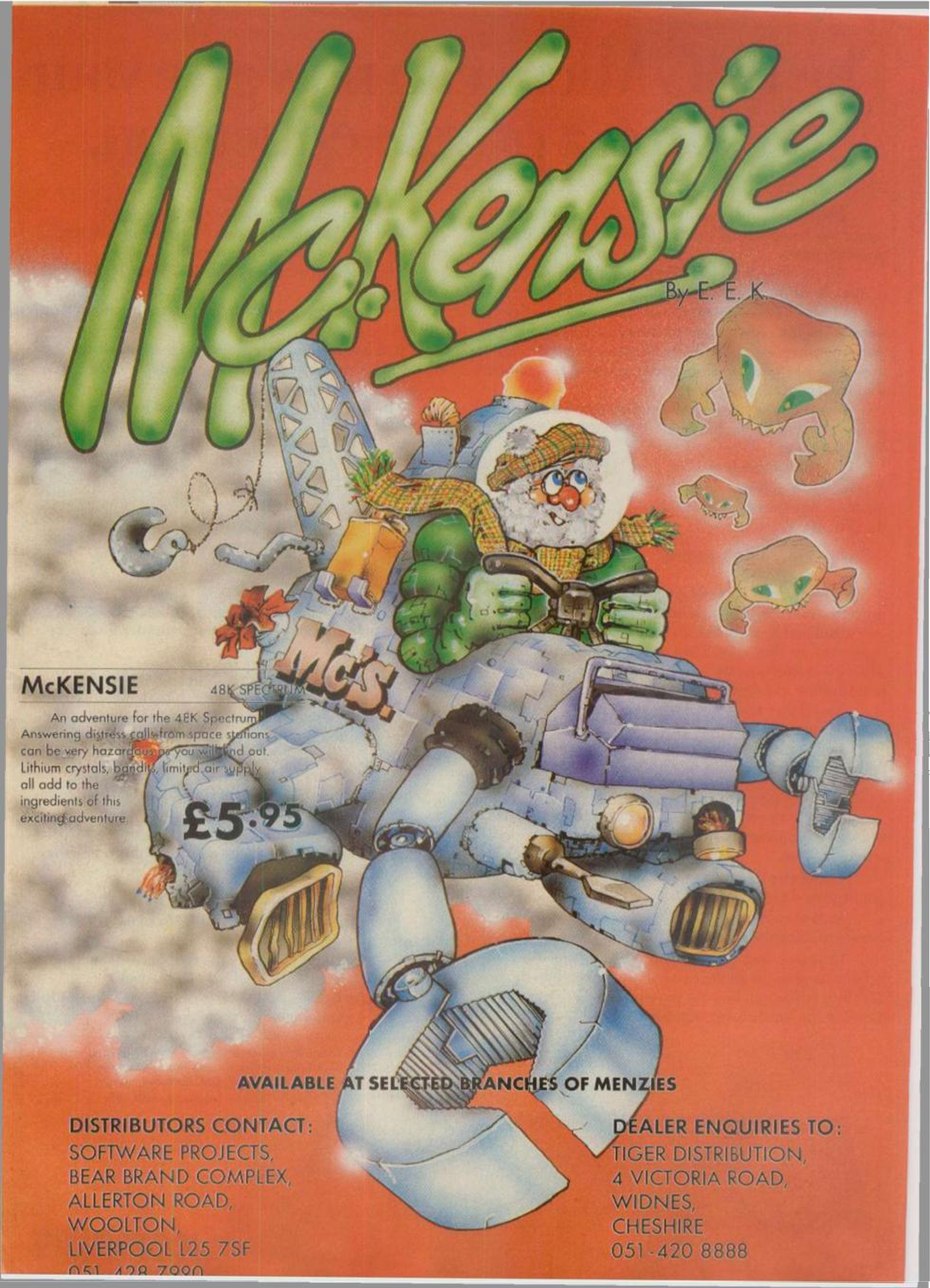
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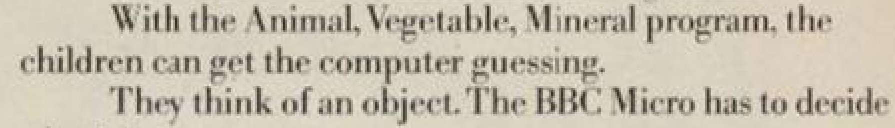
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<u>A chance to teach the Micro a thing or two.</u>

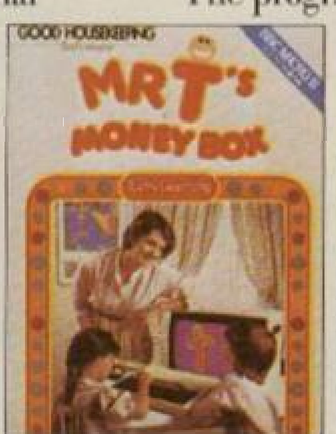
With the Animal, Vegetable, Mineral program, the children can get the computer guessing.

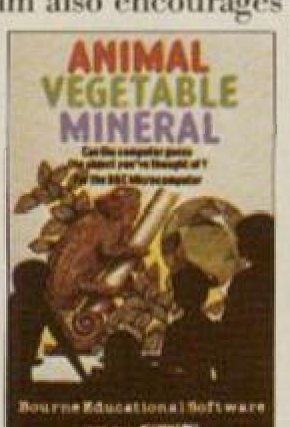
They think of an object. The BBC Micro has to decide what it is.

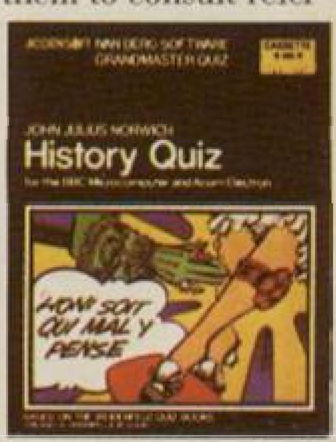
If it doesn't come up with the answer, the children can keep giving it hints.

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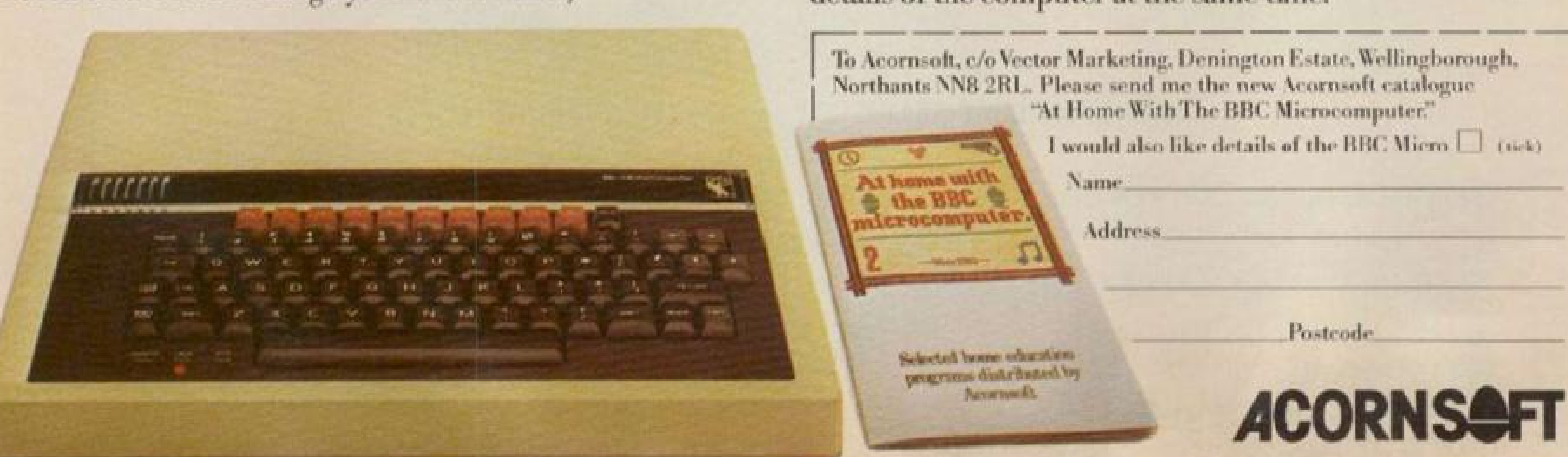
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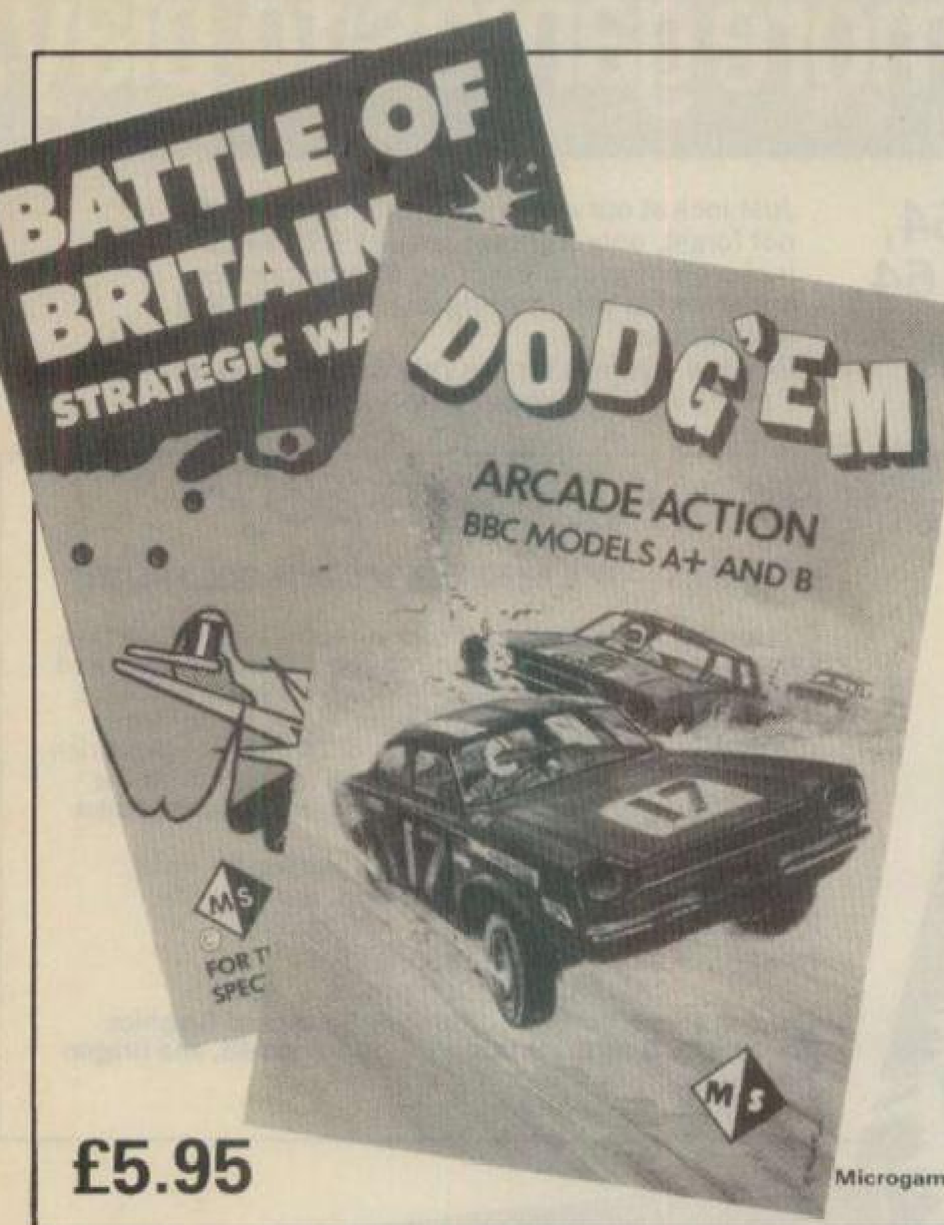
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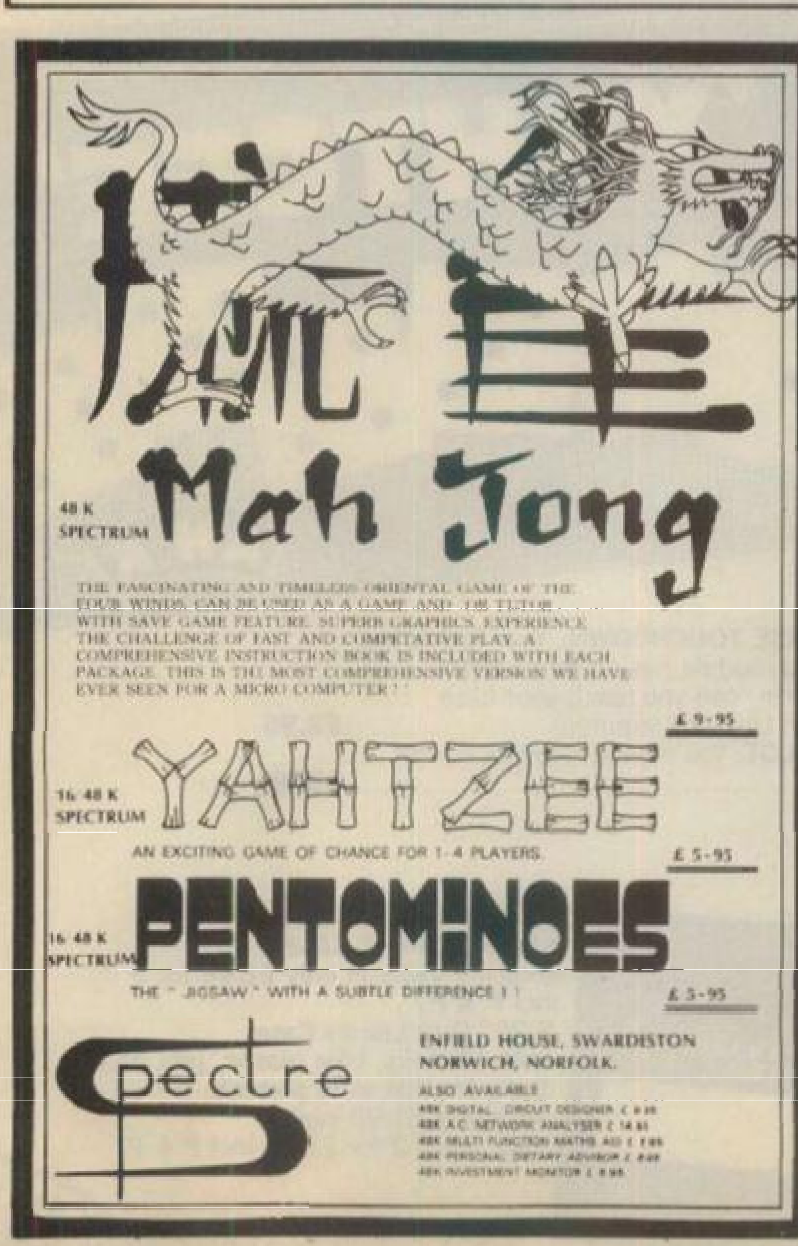
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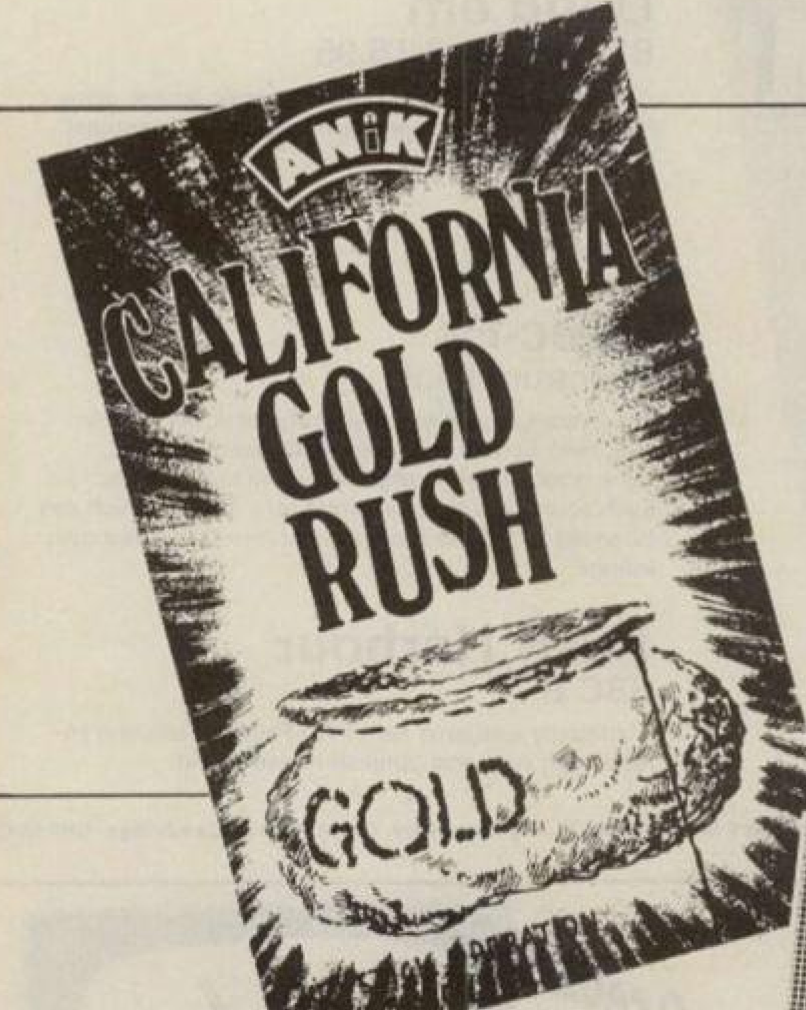




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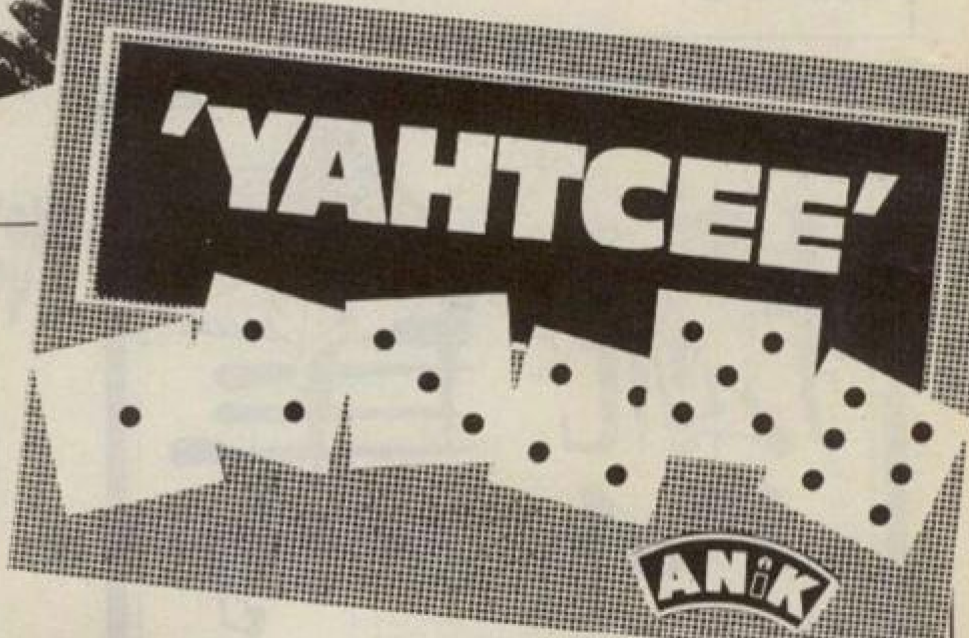
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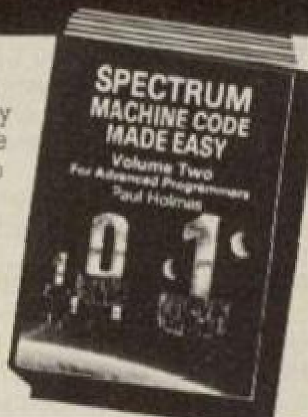
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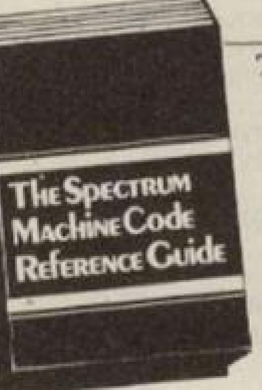


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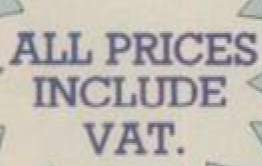
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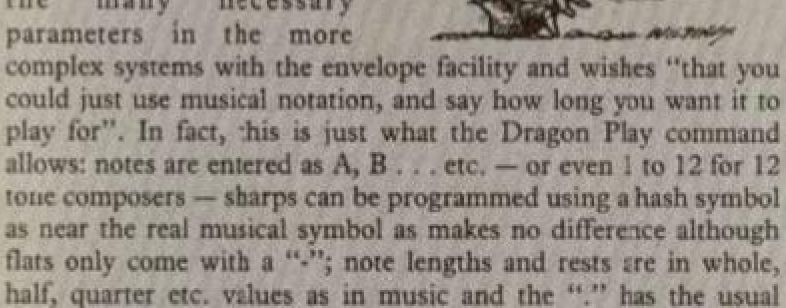
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THE ROAR OF THE DRAGON

While I agree that the single sound on the Dragon is a limitation, the comparison with the other machines — First Bytes, November — is decidedly unfair on the Dragon.

The table shows three machines with single channels — Spectrum, Oric and Dragon — of which only the Dragon gets the comment "poor". True, the Spectrum has white noise and the Oric has some nondescript predefined sounds, but only the Dragon produces the sound via the TV, rated as a distinct advantage in the accompanying text.

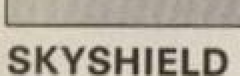




Further, the text points out the difficulties arising from the many necessary parameters in the more complex systems with the envelope facility and wishes "that you could just use musical notation, and say how long you want it to play for". In fact, this is just what the Dragon Play command allows: notes are entered as A, B . . . etc. — or even 1 to 12 for 12 tone composers — sharps can be programmed using a hash symbol as near the real musical symbol as makes no difference although flats only come with a "-"; note lengths and rests are in whole, half, quarter etc. values as in music and the "." has the usual musical conotation.

Volume and tempo — which have no absolute musical notation — can be easily defined. Indeed, apart from programming music, this flexibility makes it possible to program different arbitrary sounds.

F G Hollimar, Harrogate.



SKYSHIELD

Referring to Sky Shield program in the December issue, there are twelve numbers missing. They read as follow:

Address	Value
10240	134
10241	8
10242	51
10243	195
10244	48
10245	0
10246	31
8514	0
8515	240
8516	37
8517	244
8518	57

A M Richards, Haywards Heath, Sussex.

BETTER STOMP

Having recently bought DK-Tronics Centipede, I was amazed to find a superior program in Novembers issue of *Your Computer*.

Maggot Stomp by J Charlesworth continues *Your Computer's* trend of providing professional quality software for the Spectrum.

To make the game slightly more playable, if you

```
POKE 31435,0
```

then the maggot returns to the top of the screen once it reaches the bottom.

On the machine code: I notice J Charlesworth uses the powerful Z-80 instruction LDIR, but further savings could be made in the keyboard subroutines. Instead of, for example:

```
IN A,(c)
AND 16
CP 16
JR Z d :
```

to mask off one key,

```
IN A,(c)
BIT 4,A
JR NZ d
```

does the same with a 2 byte saving, etc.

E A Kissack, RAF Wildenrath.

SAVE BYPASS

Here is the answer to a problem that seems to have been irritating some Spectrum programmers, recently, ie: how to by-pass the cassette-saving message during multiple Saves.

Simply precede each Save with Poke 23736,181 ie.,

```
1000 FOR a = 1 to 5: PRINT a : SAVE n$(a) : PAUSE 150 : POKE 23736,181 : NEXT a
```

The first Save is normal, that is, the message "Start tape, then press any key" is Printed, and you must press a key, but all subsequent Saves are automatic.

The Pause 150 simply allows a three-second gap between recordings. The Poke is not permanent; after each Save, the operating system re-writes the normal value back into 23736.

It works by altering the pointer in Chains storing the address of the keyboard input subroutine, so that the routine is entered several bytes further forward into the routine, at a point normally reached only after a normal, valid key press, so that as far as the Save command is concerned, you have just pressed a key, so the message is cleared and Saving starts immediately.

This is therefore a neat, simple solution to an irritating problem.

You may also be interested to know that the Sinclair Spectrum manual is incorrect in stating that a Pause may be terminated by a key press only after the Pause has started. Try this:

```
10 For a = 1 TO 100 : NEXT a :
   PRINT "Loop done"
20 PAUSE O
30 PRINT "PAUSE TERMINATED"
```

If you Run this program, and press a valid key during the For/Next loop, the Pause will wait exactly one interrupt then terminate.

On entry to the Pause routine, the programmer ought to have reset bit 5 of Flags — bit 5 = 1 when a valid key code is in the key buffer — so that only subsequent key presses could terminate a Pause, instead of previous ones.

The cure is simple: precede your Pause with Pause 1. Add this line to the above program, and all will be well.

```
15 PAUSE 1
```

Michael J Sims, Dundee.

VARIABLE SAVE

While writing an adventure program I discovered a method of Saving a program's variables. This may be of special interest to D A C Patrick in December's Response Frame. This works by moving the beginning of the Basic program stored in the system variable program to the beginning of the variables stored at Vars. This effectively makes the program lines disappear, though the program still runs as the current line is stored elsewhere in the memory. The program is then Saved on tape i.e. only the variables. Next the Basic program is returned so the program can continue.

To load the variables use the instructions:

```
MERGE "name"
  20 GOSUB 1000 : REM SAVE
1000 REM SAVE ROUTINE
1010 LET PK1 = PEEK 23635: LET PK2
      = PEEK 23636: POKE 23635,
      PEEK 23627: POKE 23636, PEEK
      223628: SAVE "name": POKE
      23635,PK1: POKE 23636,PK2
1020 RETURN
```

Line 1010 must not be split up.

Michael Horner, Horsforth, Leeds.

3D ON 16K

Not wishing to see 16K Spectrum owners missing out, I would like to point out that Ian Brissenden's 3-D graphics plotter will work on a 16K Spectrum, not just on a 48K machine.

I was interested by his point on integers, and so decided to investigate. The following program and print out explain the anomaly: that when x=1, INT (X)=0, but only in some cases.

'OVER-CAUTIOUS' ON BREAK-IN

With reference to the letter from Mr J Keery, December *Your Computer:* There is a very simple solution to improve Response Frame without further cost or drastic change on the part of *Your Computer*.

Merely include the full address of the reader requiring information — assuming the reader is agreeable — then, should any reader, such as Mr Keery, believe they can expand on the advice given, then it would be a simple matter to write direct to the reader concerned.

My only criticism of Response Frame is the over-cautiousness displayed when dealing with queries regarding breaking in to commercial cassettes.

Response Frame, in my opinion, might just as well answer this type of query honestly and give the details required for two very good reasons:

First, the fear that copyright will be breached is somewhat unfounded. Anyone who wished to copy tapes for profit would not approach any computer magazine to ask how! In any case there are many cassettes available for just that purpose.

The second reason is that any reader who innocently writes to ask how to break into a cassette, hoping to learn better programming techniques, has probably not reached the level of programming skill needed to make use of the information so gained. Take for example that popular tape for the Spectrum, the Hobbit. It is not difficult to break in and in fact it only takes slightly longer to break in than to load it normally. Thus an inexperienced programmer who has been told how to break in to such a tape has two choices, either forget it or learn machine-code and tackle it.

I would suspect that the writers and publishers of such a tape would be more concerned about wholesale illegal copying of their product than someone breaking in to it to find out how it was written.

P Sutton, Brighton, Sussex.

In this case the Spectrum stores the number in five byte floating point format, ie., to see what the number is we apply:

number = m × 2^e

where m is the mantissa (1>m>0.5) and e is the exponent (a whole number, byte value − 128)

To avoid to much waffle see Chapter 24 of the Spectrum Manual. As will be seen from the print out when n=1 the exponent is 128 and the mantissa is 0.999999999999r.

Therefore

n = 0.99999r × 2(128−128) = 0.99999r × 1

INT(n) = 0

To get around this in a program use:

```
PRINT INT VAL(STR$ (X))
```

T Deacon,
Leicester,
Leicestershire.

LYNX GREEN BANK

The following short program is for the 48K Lynx and demonstrates the power of the alternative green bank of screen memory for animating graphics.

Other effects can also be obtained by replacing line 280 or 300 with either OUT &008C,4 or OUT &0080,20 or OUT &0080,8.

```
100 CLS
110 INK CYAN
120 DPOKE &6292,&A000
130 CLS
140 LET X=0
150 FOR J = X TO X+3.142/4 STEP
    0.017
160 LET A = 18* SIN(J), B = 60*
    COS(J)
170 MOVE 70-A, 120-B
180 DRAW 198-A, 120-B
190 MOVE 200-A, 120-B
200 DRAW 200+A, 120+B
210 NEXT J
220 LET X = X + 3.142/4
230 IF FRAC (2*X/3.142)=0 THEN
    DPOKE &6292,&A000
240 ELSE DPOKE &6292,&C000
250 IF X<> 3.142 THEN GOTO 150
260 DPOKE &6292,&C000
270 PAUSE 1300
280 OUT &0080,2
290 PAUSE 1300
300 OUT &0080,16
310 GOTO 270
```

John Wilkinson,
Crawley,
West Sussex.

CORRECTIONS

A couple of corrections for January's issue: the listing for the Spectrum Clone in January's Software File is correct but the instructions for running it need a little more explanation. When you typed in Goto 120 and have pressed Enter the program will Poke the machine code data into the Rem statement and then stop at line 160. Now delete lines 120 to 160 inclusive and save the program. It will now run without throwing up the error message "Ramtop No Good".

Lines 500 to 600 in the ZX81 Plane Annoying program, January, have been corrupted. The correct lines are given below.

```
500 CLS
505 LET A$="124"
510 PRINT "BOARD DIVISIONS AVAI
LABLE."
520 PRINT ,,"1) 16 X 16",,,,"2)
8 X 8",,,,"3) 4 X 4"
530 PRINT ,,"[illegible]
[illegible]"
540 GOSUB 1000
550 LET X=VAL A$(VAL I$)
560 PRINT AT 8,0;"          NOW CHO
OSE MODE.     "
570 PRINT ,,"1) EASY (SINGLE RO
US)",,,,"2) DIFFICULT (ADJACENT R
OUS)"
580 GOSUB 1000
590 IF I$>"2" THEN GOTO 580
600 POKE 17158,X+X*(I$="2")
```

EDITORIAL

FIVE YEARS AGO the first real home computer, the ZX-80, was no more than a twinkle in a thwarted watch-maker's eye-glass. In the early seventies the then plain Clive Sinclair had been forced out of the watch and calculator business by stiff competition from the Far East despite his innovations.

Now Sir Clive has announced the birth of the £399 QL. He hopes that it will grow up to be the fourth success in his happy family of computers, and the days when the Japanese could frustrate his ambitions in the field of electronic time-pieces seem so far off it is almost as if they didn't happen — and certainly couldn't happen again.

But is the QL really part of the same computing family? Its 32-bit processor, on paper at least, appears to make it the first of a new home-computer generation, an advance at least as significant as the ZX-80 breaking the £100 barrier for the first time early in 1980.

But before we are swept away in a flood of Sinclair euphoria, one should realise that the 32-bit chip that holds pride of place in the QL's specification is anchored firmly at the bottom of Motorola's 68000 range.

The 8 at the end of 68008 means that its data bus only handles eight bits at a time even though the internal architecture of the chip is the full 32. That limitation on the speed at which data can be moved in and out makes it considerably slower than the full-blown 68000 although in theory it should still be streets ahead of its nearest eight-bit rival.

All that is really only an extra enticement anyway. The real feature that will turn the QL into a success is Sinclair's name on the box — that together perhaps with the quality of the plug-in Microdrive software that comes with it.

Software will be the key to the new business market that Sinclair aims to open up. Some say that if that is the case he has put his latest machine out on a limb by giving it a new operating system, QDos, and an incompatible Basic. The biggest-selling business software titles will not run on the QL and work has not begun on converting them.

That criticism misses the point and overlooks the classic Sinclair gamble. As with the Spectrum and the ZX-81 before it, if the QL sells in the right quantities its idiosyncracies will in turn become standards in their own right. The four programs on Microdrive cartridges supplied with each machine are Sinclair's way of tiding the QL over until the independent software houses find its volume sales irresistible and start to fight to produce programs for it. The promise of its success may alone be enough to set them writing immediately. One obstacle to that could be the price Sinclair charges for blank Microdrive tapes — he is the sole supplier.

The other thing standing between the QL and business success could be the Microdrive itself. Not only is it slower than the conventional floppy disc, its reliability has yet to be proven. Would you entrust valuable business data to a device that in a single crash could cost you more than an IBM PC? If an integral Microdrive were to break down it could be the old music centre problem all over again: the whole computer might have to be returned for repair.

Pushing the range up to the £400 mark has produced a gap at £200 that Sinclair may be eager to plug. A Spectrum with a single Microdrive, interfaces and a real keyboard would involve him in virtually no new development costs and produce a computer that would take the wind out of the sails of Oric's new Atmos.

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

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Editorial: 01-661 3144
Subscriptions: U.K. £10.50 for 12 issues.

Printed in Great Britain for the proprietors Business Press International Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500 Telex/grams: 892084 BIPRESG. ISSN 0263-0885. Printed by Riverside Press Ltd, Whitstable, Kent, and typeset by Instep Ltd, London EC1.

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Sinclair Quantum Leap 32-bit micro

David Potter: Psion boss and man behind the QL's clever suite of software packages.

SINCLAIR'S QL — alias ZX-83 represents a Quantum Leap in the power of home computers according to Sir Clive even if customers used to waiting 28 days and more for Sinclair products are wondering if it really stands for Quite Late.

It certainly seems worth waiting for with 128K RAM, a 32-bit central processor, two built-in Microdrives and all the interfaces — cartridge, RS-232, joystick and RGB — that Sinclair usually leaves out, for just £399. Even the keyboard is almost of typewriter quality and there are both reset and power on/off buttons.

Also included for the money are four essential software packages for serious micro users. These are Quill — a word processor, Abacus — for planning and financial modelling, Archive — for filing which includes an electronic cheque stub and card index, and Easel — for producing multi-coloured charts.

These packages were written by Psion specially for the QL and each one has a Help screen in case you get lost.

The QL is based around 68008 chip although it also has an 8049 processor to handle the keyboard, sound and RS-232.

The Motorola 68008 has a 8-bit data bus which allows it to address up to 1 Megabyte of memory instantaneously — which is just as well now that Sinclair plans a 0.5 Megabyte plug-in RAM cartridge for the QL.

The standard QL has 90K RAM free for programs which can be stored and accessed from the pair of 100K Microdrives built in to the QL. These are not quite the same as the standard Microdrives although the plug-in Microdrive cartridges can be re-formatted for use with the QL.

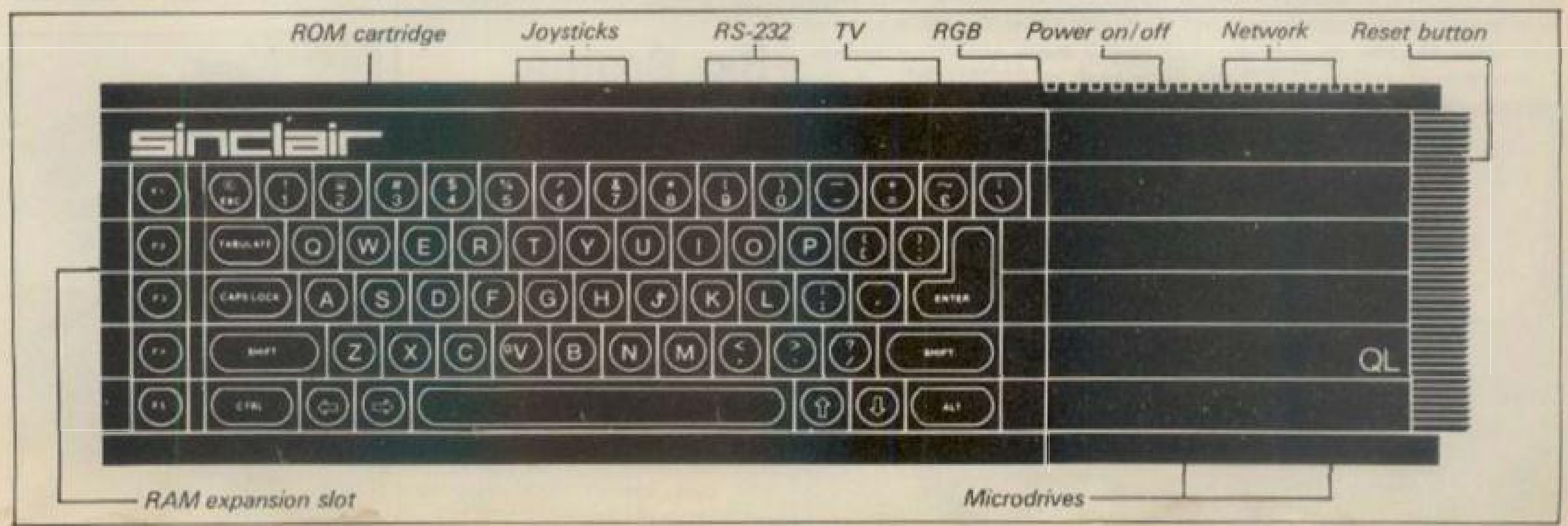
QL Basic, or SuperBasic as Sinclair insists on calling it, is a structured evolution of Sinclair Basic rather than a radically new language. The QL was still waiting for a final version of SuperBasic at its launch.

The Elan-style rubber-suspended keyboard is not angled towards the user but plastic legs click uncertainly into the base to provide the angle.

At £400 the QL will give the BBC Micro a hard ride although its lack of IBM compatibility may make businesses think twice before buying one. Sinclair hopes that by sheer weight of sales the major software houses will have to write packages to suit his QDos — get it — operating sysem for the QL.

Neither the Spectrum nor the ZX-81 will stop production for some time and Nigel Searle — Sinclair's managing director — is saying nothing about price cuts.

The QL brochure promises "the performance of a mini-computer for the price of a micro" but then Sinclair's advertising used to suggest that the ZX-81 was suitable for running power stations. Teething troubles and delays permitting the QL will set new standards in its price range without any need for exaggeration.



Say hello to your friendly robot chums Topo and Fred — Prism's articulate Androbots



MEET THE ANDROBOTS — cheerful pint-sized Fred and big brother Topo. "Androbots are designed to be friendly personal robots. They can 'think', talk, move, teach, learn. And grow." — or so it says in the sales brochure.

It modestly describes FRED — the £200 Friendly Robotic Educational Device as "your computer's personal creative genius". Funny — I always thought that was me. Big Brother Topo apparently becomes part of the family. And like any member of a family Topo will develop his own personality."

In reality, although Fred looks like a Cyberman sawn off at the shoulders, he is a type of turtle or buggy which you can remotely control with a TV-style infrared handset. You can either enter commands directly or connect an infrared controller to your micro and put Fred under program control. Fred has an integral pen holder to trace out where he's been and a voice synthesiser with a vocabulary of 45 barely distinguishable words.

Prism, the big computer distributors, are developing versions of Fred for the Spectrum and other home micros. The publicity for Fred and Topo claims that "it won't be long before an Androbot can mix you a drink, fetch your slippers and then perhaps settle down to a quiet evening's ironing." But although Topo costs an over the top £1,500 it is totally incapable of doing anything of the sort at present. It is little more than a three foot high executive toy, although eventually a robot arm will be available for it.

Marks out of ten for Oscar



WHAT DO the Pope, Pac-Man look-a-likes and Sebastian Coe all have in common? Mark McCormack that's who. His International Management Group organises tours and commercial deals for all sorts of international personalities from Michael Parkinson to His Holiness. Now McCormack is promoting an International Video Games competition with a $100,000 first prize for the best computer game of the year and a TV Special Oscar-style award ceremony.

All-singing, all-dancing computer takes hi-fi Amstrad into hi-tech

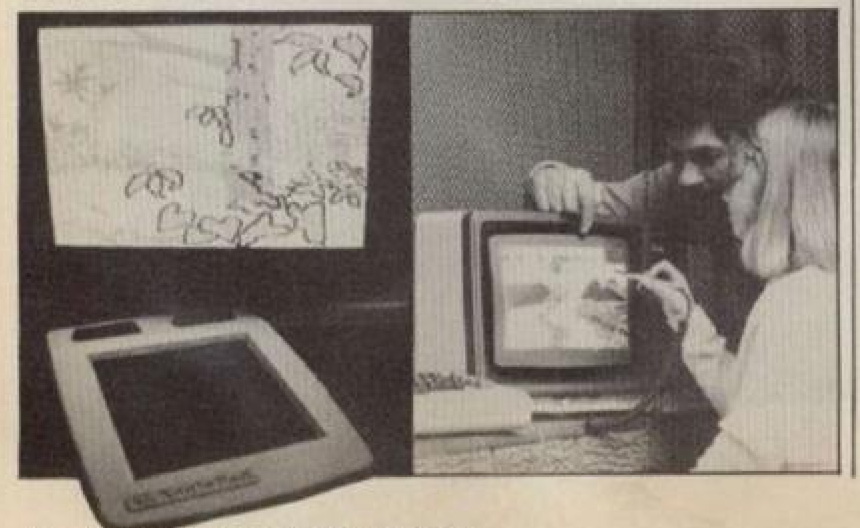
HIGH-ROLLING hi-fi giant Amstrad is about to get to grips on home computing with a £200 64K micro system including screen and tape recorder.

The company, which helped to put a stereo in every home in the early 1970s, has built up a £50 million turnover through low prices and aggressive marketing.

Marketing manager Mr Miller is cagey about the specification of the machine, which will be launched in May, but is very confident: "What we're going to offer will be extremely successful, we have tremendous experience in marketing."

Other sources say the machine will be a Z-80 based micro with 64K RAM, 80-column screen display, proper keyboard and built-in tape recorder. There may be two versions — one including a black and white TV screen for about £200 and the other including a colour monitor for around £280.

Budding artists on the Commodore 64 are spoilt for choice. The Computapix Pixstik, right, is a combination of light-pen and excellent software which allows you to paint on screen and make simple three-frame animations. The whole package costs £30 for pen, cassette and manual, which is a fraction of the £90 Audiogenic is charging for its more flexible disc-based Koala Painter, left. This uses a graphics pad which lets you draw pictures on your lap and watch them appear on screen. Computapix is on 0244-313778 and Audiogenic on 01-290 6044.



Big Brother remembers

BROTHER'S NEW printer to follow up where the EP-22 left off combines a high-definition 18×24-point dot matrix printer with a typewriter keyboard, RS-232 interface and 4,000 character built-in memory for storing text as you type it on the move.

You can feed the stored text back into your computer when you get home just as easily as you can dump from the micro on to the printer. It will cost around £200 and be available in the Spring.

Centresoft has halved the price of top Atari games by adopting no-fuss Spectrum-type packaging. Now you can enjoy Zaxxon and five other top selling titles for £15 or less.



TV stands up for itself

IF YOU'VE ever been thrown across the room by an electric shock when you've been reaching behind the television to plug in your computer the new Sony Trinitron KV 1430 may appeal to you. This is a TV specifically designed to be used with micros.

The screen is raised by a few inches so that you can see it over the top of your computer which plugs straight into a socket in the front of the Trinitron. The only snag is the price — £250 for a 14in. television.





New improved Atmos kills 99 per cent of all known Oric bugs dead

ORIC'S NEW Atmos may look like a flashy portable but under its chunky typewriter keyboard lurks the old Oric 1. Only the ROM has been changed to protect the innocent.

Oric's Peter Harding claims that all those bugs in the old operating system have been ironed out and cassette loading has been much improved. Old Oric software will still load but you first have to enter a short program from the welcome tape which comes with the Atmos and which simulates the old ROM.

Another special program will suspend the error-checking facility during loading if you suspect that all that is making the program crash is a blip in the header tape or somewhere irrelevant.

At last the other notorious fault of the Oric — the sketchy manual — has been corrected. Atmos buyers will get a full 270-page book together with a quick reference leaflet for beginners.

More than one year after the first deliveries Oric has finally put right most of the teething problems that should have been corrected before the product went on sale. Peter Harding hopes to offer people who bought the original Orics the chance to upgrade to an Atmos for about £50.

The Atmos should give the Electron and CBM-64 a tough run for their money. Although it has poorer resolution and sound than either and lacks the sprites of the Commodore and the BBC Basic of the Acorn, it has more memory available than either and at £170 is significantly cheaper.

At first sight the price is surprising since Oric 1s have been selling for as little as £130 for the 48K model recently. But Peter Harding attributes this to the January sales and attempts to clear stocks of the old model. He says Oric will not be making any more profit on the Atmos with its new keyboard, ROM, and manual than they did on the Oric 1 — of which 170,000 have been sold around the world this year.

With the new £200 Hitachi 3in. disc drive the Atmos makes an interesting contrast to Sinclair's QL.

What's the worst job you've ever had? This man has been touring the South of England for the last month dressed up as an astronaut to promote Microdeal's Space Shuttle game by handing out competition forms. Entrants had to put in order the factors they thought were most important in computer games. Now Microdeal is using a Dragon 32 to process the thousands of replies. So far, life-like graphics seems to be the competitors' priority which makes you wonder what they made of a man in a surplus spacesuit from the James Bond film Moonraker, *driving around in a Ford Transit with a cardboard space shuttle on top.*



YOUR COMPUTER TOP 20

Game	Company	Machine
Arcadia	Imagine	Vic-20
Atic Atac	Ultimate	Spectrum
Computer War	Thorn EMI	Atari
Cuthbert Goes Walkabout	Microdeal	Dragon
Gridrunner	Llamasoft	Vic-20
Harrier Attack	Durrell	Oric
Hobbit	Melbourne House	BBC
Hopper	PSS	Oric
Horace Goes Skiing	Psion	CBM-64
Hovver Bovver	Llamasoft	CBM-64
Juniors Revenge	Dragon Data	Dragon 32
Lunar Jet Man	Ultimate	Spectrum
Manic Miner	Bug Byte	Spectrum
Meta-galactic Llamas	Llamasoft	Vic-20
Missile Command	Gemini	BBC
Motor Mania	Audiogenic	CBM-64
Scramble	Quicksilva	ZX-81
3D Ant Attack	Quicksilva	Spectrum
Valhalla	Legend	Spectrum
Zaxxon	Datasoft	Atari



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☐ Jetpack	☐ Slippery Sid	☐ Brain Damage	☐ Frogger
☐ Cookie	☐ SS Enterprise	☐ Last Sunset. . .	☐ Blind Alley
☐ PSSST	☐ Nite Flite	☐ Mazeman	☐ Galactic Jailbreak
☐ Timegate	☐ Meteoroids	☐ Galaxians	☐ Transam
☐ 3D Tunnel	☐ Gulpman	☐ ETX	☐ Robotics
☐ Cosmos	☐ Cosmic Guerilla	☐ Frenzy	☐ Armageddon
☐ Cyber Rats	☐ Kong	☐ Astroblaster	☐ Exterminator
☐ Galaxians	☐ Armageddon	☐ Knot in 3D	☐ Detective
☐ Spookyman	☐ Mission Impossible	☐ Joust	

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Oric Trigga Command		£19.99
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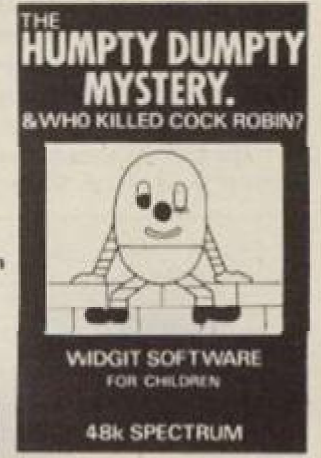
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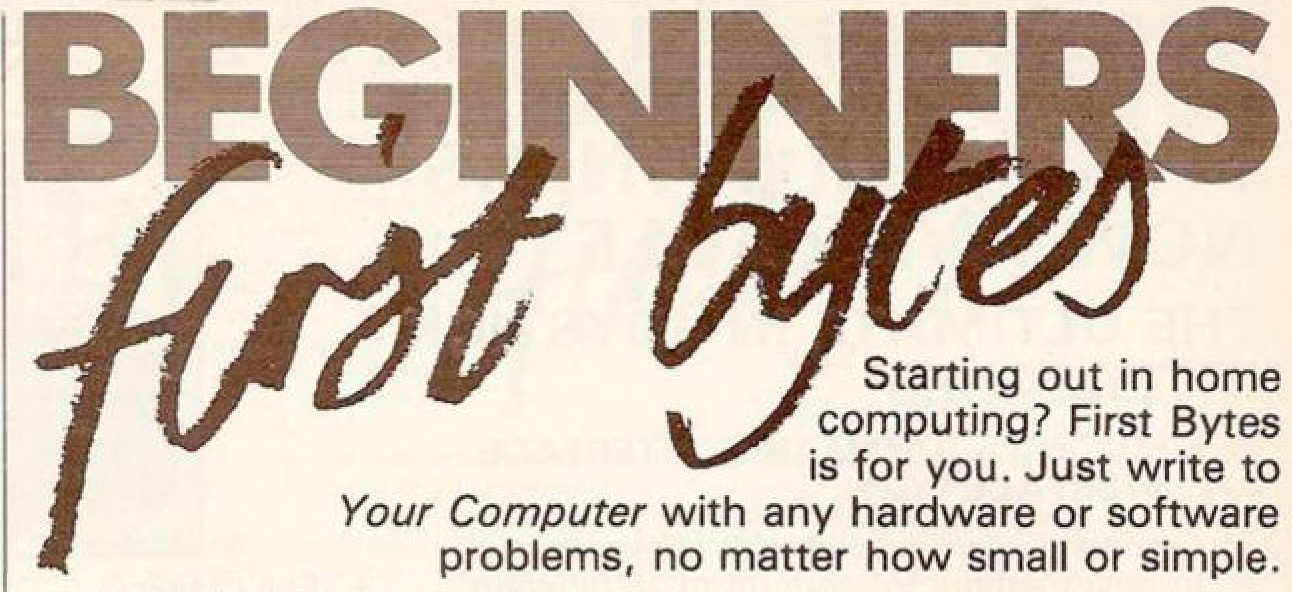
I could do that...

Write a program to work out and print Pascal's Triangle. Each number is derived by adding the two numbers above it, so that the first four lines will be:

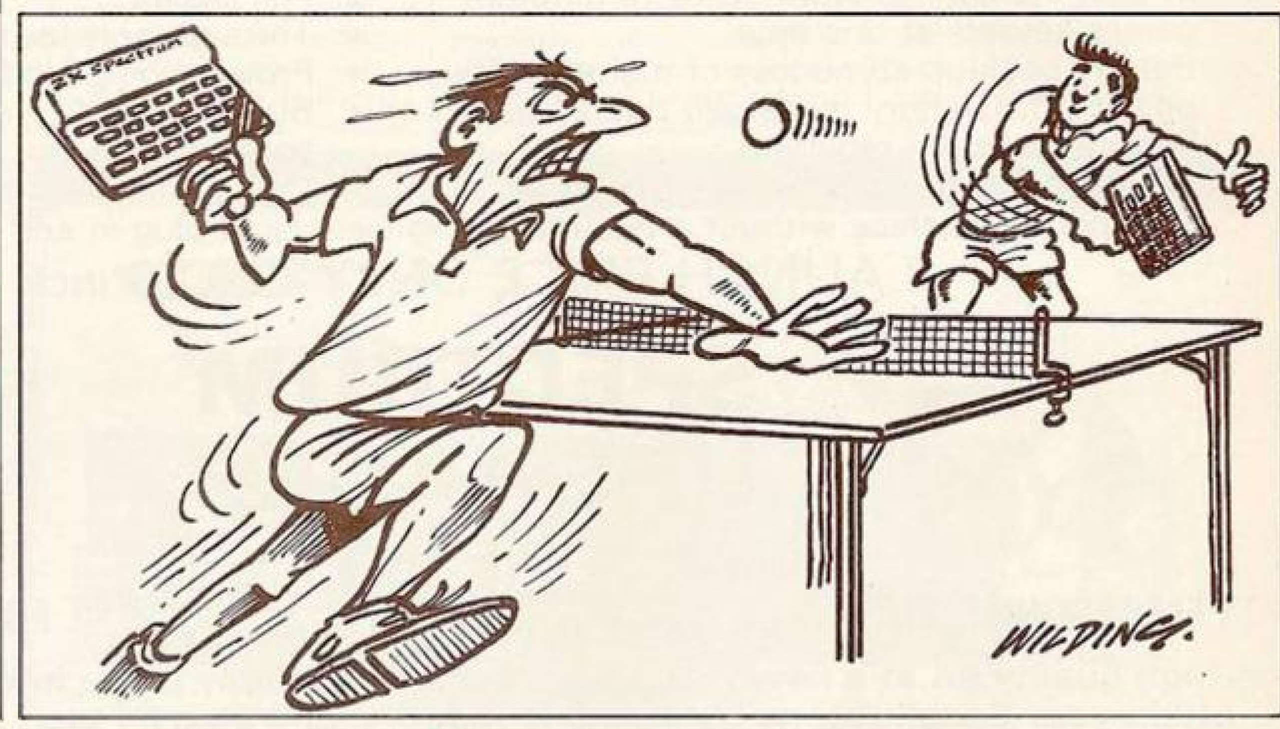
1
11
121
1331

December's *I Could Do That* problem asked for a program to perform a binary search. Most entries adopted the same technique of repeatedly chopping the array to be searched in half until a match is found. The first program to be picked from the hat came from C Bish, 35 Manor Park, Clyst St Mary, Exeter, Devon. It runs on a Spectrum and takes 0.25 seconds to locate an item in a file of 1000.

```
  10 REM a$ contains 10 data it
ems
  30 LET n=10:INPUT "ENTER NAME
 TO FIND",t$:GOSUB 1000:IF i=0 T
HEN PRINT t$;" NOT IN FILE":GOTO
 30
  40 PRINT t$; " IS NUMBER ";i:
GOTO 30
 1000 LET h=n: LET l=1: LET o=n+
1:IF a$(n)=t$ THEN LET i=n:RETUR
N
 1001 LET i=INT((l+h)/2):IF o=i
THEN LETi=0:RETURN
 1002 LET o=i:IF a$(i)=t$ THEN R
ETURN
 1003 IF a$(i)<t$ THEN LET l=i:G
OTO 1001
 1004 LET h=i:GOTO 1001
```



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The best home micro for games playing

"Which is the best home computer for games?"

BEFORE ANSWERING your question directly let us consider what it is that makes one computer more suitable for playing games on than another. Broadly speaking three factors are involved: the computer's graphics and sound facilities, the amount of RAM it offers, and the number of software houses producing software for the machine.

This last factor is by far the most important and is directly related to the number of machines sold. Obviously programmers are more interested in producing software for an established best-seller than for a newly launched machine; and the more programmers there are working on a particular machine the greater the range and quality of its programs.

Time is also important since it takes programmers time to discover how best to exploit a computer. Spectrum programs being released now are markedly superior to those of a year ago.

It is for these reasons that the current range of Spectrum games is, by and large, better than its Oric counterpart. Both machines offer comparable graphics and indeed the Oric's sound facility is more powerful than the Spectrum's. But the Spectrum has been on the market longer and sells in far greater numbers.

Provided they reach a minimum standard — say 256 by 192 pixel resolution together with eight colours — a micro's graphics capabilities play only a minor part in deciding the quality of its games. Some highly playable games have been written for the Vic-20 despite it relatively humble graphics capability.

Clearly the greater a computer's pixel and colour resolution the greater the potential will be for writing games of arcade quality. But that potential needs programmers to exploit it.

The BBC micro is a case in point. It has the finest graphics of any home computer under £500 and has some excellent games to prove it; Acornsoft's Snapper for example is probably the best home computer version of Pac-Man.

But only few of the recent games have matched the standard of Acornsoft's first batch of programs and the range of games for this micro does not compare with that of its nearest rival, the CBM-64.

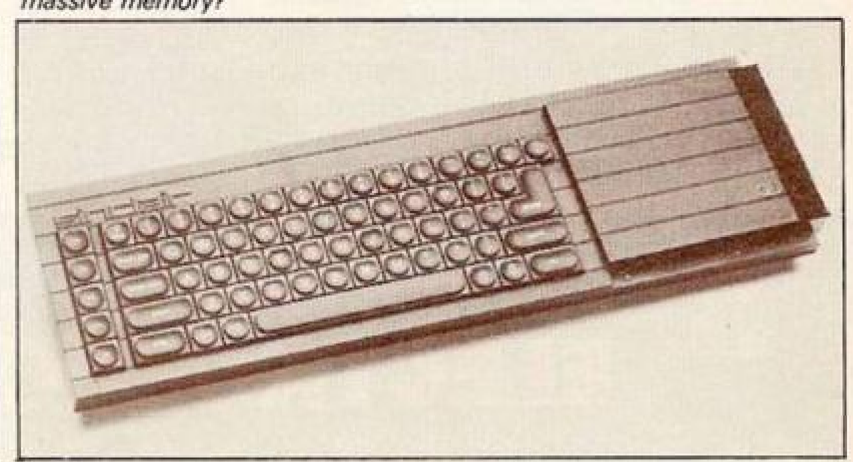
The CBM-64, however, provides nearly four times as much RAM as the BBC for high resolution games, So memory is also a factor here. Many of the more imaginative games require more than 16K. Manic Miner, for example, only runs on the 48K Spectrum and could not be converted for the BBC. It boasts 20 different screen display and takes 1K to store the details for each screen.

As indicated, the 48K Spectrum is undoubtedly the best machine under £150 for games. Its drawbacks are that its keyboard is unsatisfactory and will need to buy an interface if you wish to use joysticks.

In a higher price bracket you should consider the Atari range or the Commodore 64. Games for the Atari like Star Raiders, Eastern Front, and the recent Pole Position would probably find a place in an all-time games top ten. Unfortunately, most of these come on cartridges which are substantially more expensive than tape.

After a slow start games are now flooding in for the CBM-64.

Starting with a clean sheet — what will games programmers be able to achieve on the new Sinclair QL with its fast 32-bit processor and massive memory?



Debugging

MOST OF THE PROBLEMS people encounter in keying in magazine listings are of their own making. It is difficult to key in a long listing without making a single mistake and of course a single mistake — such as confusing a O with a 0 or missing out a comma — is usually sufficient to crash the program. Admittedly the listings themselves are sometimes error-ridden but in *Your Computer* these are rare.

However, if you know how to interpret error messages tracking down a problem in a listing can be fairly simple. This in turn reduces to knowing where to look for an error. Perhaps the most common mistake made by beginners is to assume that the program bug must be at the line referred to by the error message.

Take the following line for example:

```
40 FOR N=1 to 20: READ D. B(N)=D.
NEXT
```

When the computer executes this line it expects to find 20 Data items which it can read into the variable D. If the Data statement does not contain enough items or holds a letter instead of a number your program will crash at line 40 — despite the fact that the fault lies elsewhere.

The error message may "Insufficient Data" which is clear enough but it is equally likely to be something more obscure like "Integer out of range" or even — on Sinclair machines — "Nonsense in Basic".

Naturally enough the solution here is to check your Data statements. If these are numerous you may be able to trace the fault to a particular Data statement. Type in Print N directly from the keyboard and you will be able to work out where in the list of data the program has stopped.

This technique of examining variables is often useful in debugging. Remember that the computer retains its variables even though the program has crashed. "Subscript out of range" means that the variable within brackets in an array is to large or negative. Print out its value and then find out where in the program it is being set incorrectly.

To debug these errors it not necessary to understand how the program works. When it runs but fails to do what it is intended to, you will need to try and fathom out its logic. The judicious use of the Stop statement is useful here. By inserting Stop statements at various points you can narrow down the problem areas to one or two routines.



Comparing different Basics

"Why are some Basics said to be more powerful than others?"

THE DIFFERENT versions of Basic are often referred to as dialects of the same language. Like natural language dialects their differences are sometimes just a matter of using different words for the same command. Thus Sinclair Basic uses To to handle string splicing while most other versions use the commands Mid$, Left$, Right$. Although To might be rather easier to use than Mid$ it performs the same function.

However, what makes some Basics more powerful than others is the presence of extra commands and one area that sorts out the weak Basics from the strong is graphics. Commodore Basic, for example, is strikingly lacking in any commands to plot points or lines. Unlike the Spectrum with its Plot, Draw and Circle commands the CBM-64 requires you to Poke your pixels into the screen memory.

BBC Basic is particularly well endowed with graphic commands. These allow such facilities as both relative and absolute plotting, filling areas, and defining separate graphics and text windows.

BBC Basic is well equipped in other departments too and is unquestionaly the most powerful version of the language available on a home micro. One reason for its superiority is that its interpreter is twice as big as most other Basic interpreters — it occupies 16K ROM as opposed to 8K.

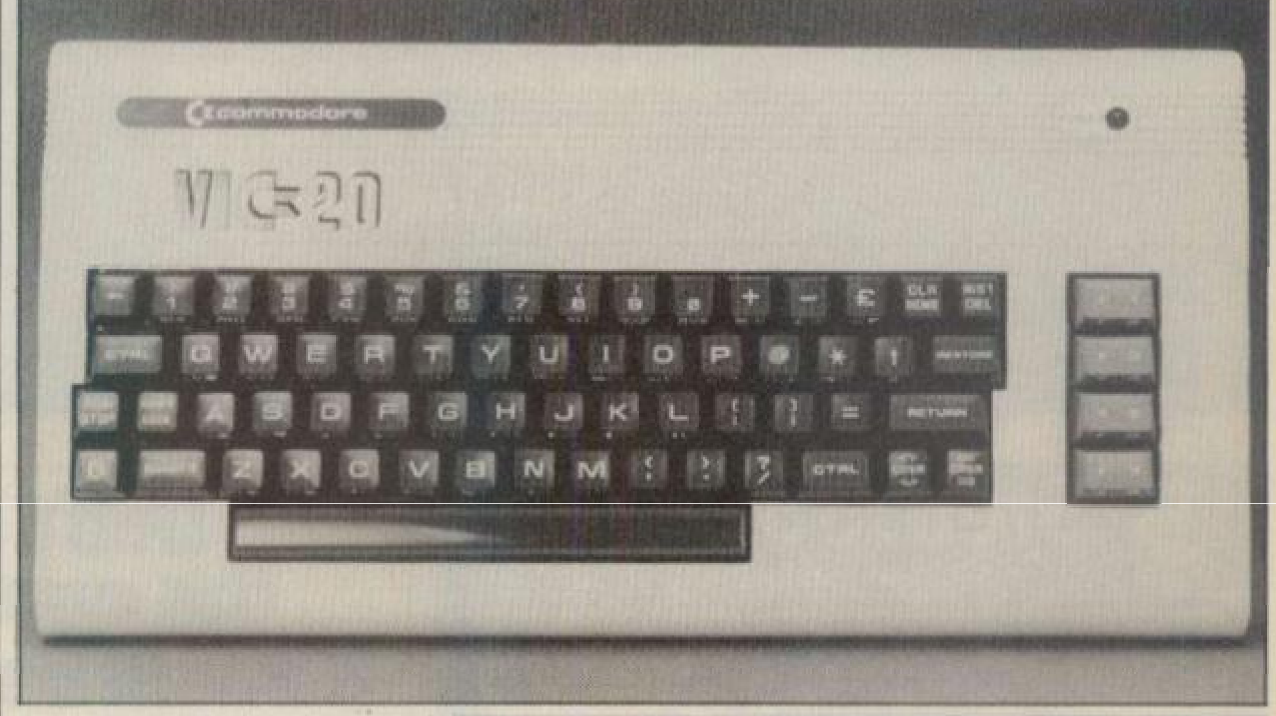
It is worth taking a closer look at BBC Basic since it gives an idea of what the language is capable of. One of its strengths is that it allows you to write structured programs. Put simply structured programming means programming without Gotos. It is extremely difficult to fathom the control structure of a program which is shot through with Goto statements. By providing the facility for named procedures and commands such as Repeat Until or If Then Else, BBC Basic enables you to write programs whose structure is more readily apparent. Only Lynx Basic offers comparable features.

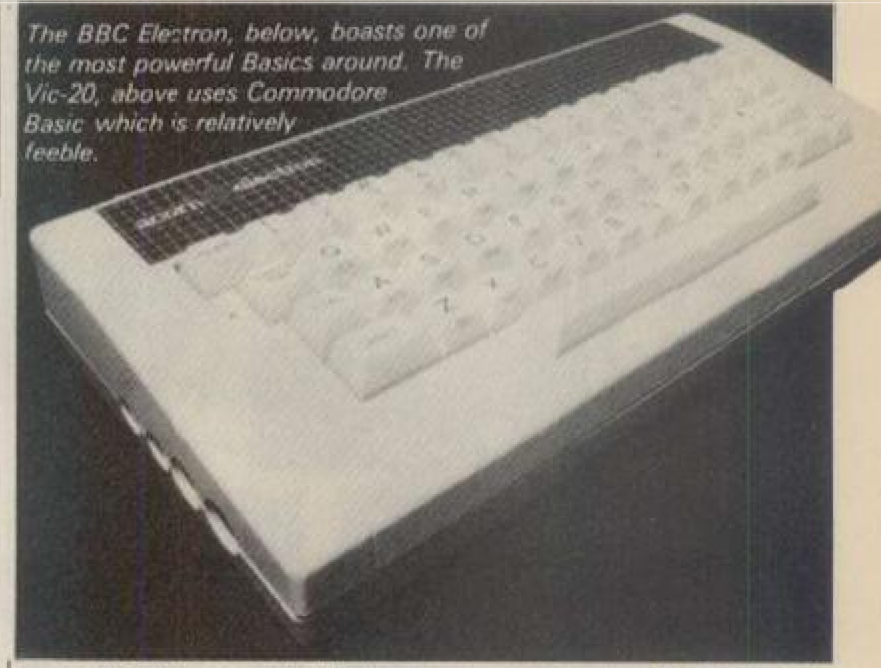
BBC Basic also boasts a number of programming utilities — Auto, Renumber, Delete, Trace — not generally found in other Basics. These cannot be used within a program but make the task of developing and debugging a program easier.

Perhaps more useful than these utilities is a good editor and this is one area where BBC Basic does not reign supreme. Despite its dificiencies Commodore Basic has the advantage of an excellent full screen editor which lets you move the cursor to a line and edit it on the spot. As such it is preferable to line editors like those on the BBC and Spectrum which require you to pull the line down first.

Speed is another measure of the power of different Basics. Here again BBC Basic scores highly. It is twice as fast as CBM Basic and three times as fast as Spectrum Basic. This can make the difference between being able to write an adequate game in Basic and being forced to turn to machine code.

If the Basic on your machine now seems a little threadbare in comparison with BBC Basic take consolation: you can always customise your Basic. By adding the Simons Basic cartridge to the CBM-64 you can extend the resident language by a further 114 commands. On a smaller scale *Your Computer* often prints machine code routines to give extra commands.





The BBC Electron, below, boasts one of the most powerful Basics around. The Vic-20, above uses Commodore Basic which is relatively feeble.

If you have anything of interest to tell us about your computer club why not contact us on 01-661 3144.

Local news

Manchester

A rapidly-burgeoning BBC user group has recently been formed in South Manchester. Meetings are held regularly every fortnight at 229 Manley Road, Chorlton-cum-Hardy, Manchester M211RB. It is hoped to move to larger premises soon. The club which has already evolved its own program enabling Saving of cassette programs or disc, plans to develop into four sections, one devoted to Basic programming, one to assembler, one section to be hardware-related — peripherals and so on — and one general group pulling all these areas together. Contact Mr D K Davies 061 991-0382.

Scunthorpe

The Grange Farm ZX Computer Club is no longer Sinclair-dedicated, but keeps its old name to distinguish it from other groups in the area. Meetings are held every Wednesday at 7pm at the Grange Farm Hobby Centre, Scunthorpe, South Humberside. The club which has around 40 members, will soon be commencing a series of talks on topics relating to machine-code programming. Membership is £2 per annum for junior and student members — plus 15p per meeting — £5 per annum for other members, plus 25p per meeting. For further details, get in touch with the club secretary, Colin Hazelton, at 26 Rileston Place, Bottisford, Scunthorpe, South Humberside. Telephone 0724-863466.

Stratford

If Shakespeare had been into microcomputer hardware, would he have been a printed circuit bard? However this may be, the Stratford Computer Club meets once monthly at the Wesley Hall from 7 to 9pm. Contact Chris Parry, 16 Sackville Close, Stratford-upon-Avon, Warwickshire. Telephone 0789-68080.

COMPUTER club



PURBECK

Paul Bond finds the UK Atomic Energy Authority experimenting with the BBC micro and discovers a following for the ill-starred NewBrain.

Purbeck Computer Users' Club was deeply immersed in self-analysis when *Your Computer* visited Wareham in Dorset recently. After a big initial success and a primary intake of over 70 members, it was felt that things were tailing off slightly. However, at the annual general meeting, the members could look back to a few successes.

Keith Farmer, the club treasurer, revealed that the income from membership fees and also from a course which the class had run had netted enough money to purchase a Seikosha 250 printer, and still leave a little in the bank.

The course itself — a series of tutorials in Basic programming based on the Dragon 32 micro — was also a success, attracting many people new to computing. The series of lessons were given by club chairman David Delaney. He is well-qualified for this since he is also head of Computer Studies at the local school. Two of his pupils studying A-level computing, Stephen Moore and Nigel Mattstead, were also present at the club.

The club was founded some 12 months ago by a small group of people who decided to take advantage of computer shop owner Alan Monahans offer to support the club with monitors in the early stages. The shop also stocked primarily NewBrains and Dragons which explains the predominance of these kind of machines among members. Due to the educational interest there is also a strong representation from the BBC Micro. David Delaney explained that the club was experimenting with communications between computers using the RS-423 interfaces.

Another sort of interfacing was being experimented with by David Mockford of the Atomic Energy Authority. Apparently the UKAEA has *carte blanche* to experiment with micros to see what they can be used for — but jokes about that famous inital ZX-81 advert claiming you could run a nuclear power station with one tend to fall rather flat.

Mr Mockford intends to construct an interface box hooking a BBC Micro into a PDP-11. Apparently the BBC is capable of 10-bit precision, whereas the PDP-11 is only capable of eight-bit precision. Club treasurer Keith Farmer confessed himself to be a puzzle fanatic, and said that this was what his interest in home computing stemmed from. He owns two micros — a Vic-20 and an Oric. He has had some problems with the Oric as regards loading but has managed to cure most of the difficulties with the purchase of a voltage-stabiliser plug.



A recent victim of the micro-computer market reaper is the NewBrain computer. Alan White, who runs his own engineering company and also participates in the organisation of the local folk club at the Antelope public house, was nevertheless fervent in the defence of the machine. He pointed out that the company had changed hands recently, and maintained that since there was a large standing order for NewBrains for use in the schools of the Federal Republic of Germany, we may yet see a revival of the machine in this country.

He was amazed at the number of character sets possessed by the micro and had used this to great advantage in his own word-processing applications. By changing the character set from time to time it was possible to reduce some of the strain of staring at the screen, he said. He had developed an accounts program which was of considerable assistance in running his business. "Better than having bits of paper laying around all over the place."

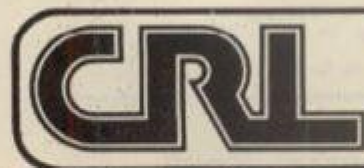
For more details about Purbeck Computer Users' Club, contact Alan Monahan on 09295 51383.

Buy FIFTH and get a City Bomber FREE!

Just TYPE in this program by Richard Taylor with your Fifth Interpreter.

```
2 REM *          BOMBER          *
3 REM *   By RICHARD TAYLOR      *
4 REM * © CRL September '83      *
5 REM ****************************
6 REM
10 RANDOMIZE 1000
20 RANDOMIZE USR 61030
30 RANDOMIZE : BORDER 6
40 OVER 0: INVERSE 0: FLASH 0
50 BRIGHT 0: INK 0: PAPER 7
60 CLS
70 GO SUB 9000
80 GO SUB 8000
90 LET Hi=0: LET z=1: LET Score=0
100 CLS : PRINT "  HI:";Hi;TAB 20;"SCORE:";Score
110 PLOT 0,163: DRAW 255,0
120 LET a=4000: REM LIMIT a
130 LET a=6000: REM INTERACT a
140 GO SUB 3000
150 LET x=0: LET y=50: REM MOVE Plane,x,y
160 LET x=255: LET a=30: REM MOVE Enemy,x,a
170 GO SUB 2000: GO TO 170
1000 LET a=0: LET b=176
1010 REM MOVE Plane,a,b\ENABLE Plane
1020 REM ALL Bomb\MOVE Bomb,a,b
1030 REM ENABLE Bomb
1040 REM MOVE Enemy,a,b\ENABLE Enemy
1050 CLS
1060 FOR a=0 TO 7
1070 PRINT PAPER a;: REM FILL
1080 BEEP .1,a*5: NEXT a
1090 PAUSE 25: FOR a=60 TO 0 STEP -1: BEEP .005,a: NEXT a
1100 FOR c=0 TO 1000 STEP 20
1110 LET a=10: LET b=3: LET d=50
1120 REM SOUND a,b,c,d
1130 NEXT c
1140 LET a$="SCORE:"+STR$ Score
1150 LET x=0: LET y=60: LET l=2: LET w=3
1160 REM TEMPS\LARGE
1170 IF Hi>Score THEN GO TO 1200
1180 LET Hi=Score: LET a$="A New HIGH SCORE"
1190 LET x=60: LET y=100: LET l=2: LET w=1: PRINT INK 1;: REM LARGE
1200 PRINT #0; FLASH 1;"          A New Level? [y/n]   "
1210 IF INKEY$<>"" THEN GO TO 1210
1220 IF INKEY$="n" OR INKEY$="N" THEN GO TO 1500
1230 IF INKEY$<>"y" AND INKEY$<>"Y" THEN GO TO 1220
1240 INPUT "New Level? ";Level
1250 IF Level<0 OR Level>3 OR Level<>INT Level THEN GO TO 1240
1260 GO TO 90
1500 INPUT INKEY$: PRINT #0; FLASH 1;"         Another Game? [y/n]   "
1510 IF INKEY$<>"" THEN GO TO 1510
1520 IF INKEY$="y" OR INKEY$="Y" THEN LET Score=0: LET z=1: GO TO 100
1530 IF INKEY$<>"n" AND INKEY$<>"N" THEN GO TO 1520
1540 LET a$="OK": LET w=16: LET l=22
1550 CLS
1560 LET x=0: LET y=0: REM TEMPS\LARGE
1570 LET a=21: LET b=31: REM GET x/y,a,b,a$
1580 FOR a=0 TO 21: LET b=a*.6875
1590 REM PUT a,b,a$
1600 PAUSE 5: NEXT a
1610 LET a=INT (RND*8): PAPER a: BORDER a: CLS : BEEP 1,-10
1620 GO TO 1610
2000 LET a$=INKEY$: IF a$="" THEN RETURN
2010 IF a$="6" THEN LET y=y+1+(Level(2): LET Score=Score-2
2020 IF a$="7" THEN LET y=y-1-(Level(2): LET Score=Score-10
2025 PRINT AT 0,26;Score;"  "
2030 IF y<20 THEN LET y=20
2032 IF y>168 THEN LET y=168
2035 REM MOVE Plane,COLUMN Plane,y
2040 IF a$<>"0" THEN RETURN
2050 REM USE Bomb,z
2060 LET z=z+1: IF z=4 THEN LET z=1
2070 REM LET a=LINE Plane\LET b=COLUMN Plane\LET c=LINE Bomb
2075 IF c<>176 THEN RETURN
2080 LET a=a+10: LET c=(INT ((c+4)/8))-32*(c>250): REM MOVE Bomb,b,a
2090 RETURN
3000 FOR a=2 TO 31: LET b=INT (RND*10)+1: IF RND>.8 THEN GO TO 3040
3010 LET d=INT (RND*5): FOR c=21 TO 21-b STEP -1
3020 PRINT AT c,a; INK d; BRIGHT RND;"▇": BEEP .005,c+25: NEXT c
3030 PRINT AT c,a; INK d;"▲"
3040 NEXT a: RETURN
4000 REM LMTPARAM
4010 IF h$="plane" THEN GO TO 5000
4015 IF h$="enemy" THEN GO TO 4500
4020 LET o=176: REM LET p=CURRENT h$\USE h$,h\MOVE h$,COLUMN h$,o\ENABLE h$\USE h$,p
4030 CONTINUE
4500 REM LET o=LINE enemy
4510 LET o=o+11+INT (RND*6): IF o>=150 THEN LET o=150
4520 IF o<20 THEN LET o=20
4530 LET p=255: REM MOVE enemy,p,o\ENABLE enemy
4540 CONTINUE
5000 REM LET y=LINE Plane
5010 LET p=0: LET y=y+4: IF y>=168 THEN GO TO 5500
5020 REM MOVE Plane,p,y\ENABLE Plane
5030 LET Score=Score-1: PRINT AT 0,26;Score;"  "
5040 BEEP .005,60: CONTINUE
5500 LET a=176: LET b=0: REM MOVE Plane,b,a\ENABLE Plane
5510 REM MOVE Enemy,b,a\ENABLE Enemy
5520 REM ALL Bomb\MOVE Bomb,b,a\ENABLE Bomb
5530 POKE 23681,0: CLS
5540 LET a$="YOU HAVE LANDED"
5550 LET w=2: LET l=1: LET x=0: LET y=0
5560 PRINT INK 2;: REM LARGE
5570 LET Score=Score+200
5580 GO TO 1000
6000 REM INTPARAM
6010 IF h$="bomb" OR i$="bomb" THEN GO TO 7000
6020 IF h$="plane" OR i$="plane" THEN POKE 23681,0: GO TO 1000
6030 LET p=255: LET o=50: REM MOVE enemy,p,o\ENABLE enemy
6040 CONTINUE
7000 IF h$="enemy" OR i$="enemy" THEN GO TO 7500
7005 IF i$="bomb" THEN LET h=i
7010 LET o=176: REM LET p=CURRENT Bomb\USE Bomb,h\LET q=LINE Bomb\LET r=COLUMN Bomb\MOVE Bomb,COLUMN Bomb,o\ENABLE Bomb\USE Bomb,p
7020 LET q=INT (q/8): LET r=INT (r/8): IF r>31 THEN LET r=31
7025 IF q>21 THEN LET q=21
7030 LET p=q+INT (RND*5)+1: IF p>21 THEN LET p=21
7035 FOR o=q TO 10 STEP -1: PRINT AT o,r-1+(r=0);" ";AT o,r;" ";AT o,r+1-(r=31);" ": BEEP .01,o+30: NEXT o
7040 FOR o=q TO p: PRINT AT o,r-1+(r=0);" ";AT o,r;" ";AT o,r+1-(r=31);" ": BEEP .01,o+30: NEXT o
7070 LET Score=Score+8-(Level*2): PRINT AT 0,26;Score;"  "
7080 CONTINUE
7500 LET o=50: REM MOVE Enemy,COLUMN Enemy,o\ENABLE Enemy
7510 IF h$="bomb" THEN LET i=h
7520 REM LET p=CURRENT Bomb\USE Bomb,i\MOVE Bomb,COLUMN Bomb,o\ENABLE Bomb\USE Bomb,p
7530 CONTINUE
8000 LET a$="BOMBER": LET x=0
8010 LET y=0: LET l=2: LET w=5
8020 PRINT PAPER 5; BRIGHT 1;"
8030 REM LARGE
8040 PLOT 0,160: DRAW 255,0
8050 LET a$="  A Game using"
8060 LET x=0: LET y=25
8070 LET l=1: LET w=2
8080 REM TEMPS\LARGE
8090 PLOT 0,0: DRAW 255,0
8100 DRAW 0,175: DRAW -255,0
8110 DRAW 0,-175: LET l=3
8120 LET w=6: LET x=8
8130 LET y=35: LET a$="FIFTH"
8140 PRINT INK 2;: REM LARGE
8150 LET l=2: LET w=1
8160 LET x=55: LET y=65
8170 LET a$="By RICHARD TAYLOR"
8180 PRINT INK 1;: REM LARGE
8190 PRINT AT 12,5;"Key 6 to move down"
8200 PRINT AT 14,5;"Key 7 to move up"
8210 PRINT AT 16,5;"Key 0 to drop a bomb"
8220 PRINT AT 18,3;" You must clear a path to";AT 19,3;"land on"
8230 LET a=3: REM OBJECT Bomb,a
8240 LET a=1: REM OBJECT Plane,a
8250 REM OBJECT Enemy,a
8260 REM PRINT Bomb,a
8270 REM PRINT Plane,■\PRINT Enemy,■
8280 LET a=1: LET d=2: LET b=3: LET c=6
8290 REM SPEED Bomb,b,c
8300 REM SPEED Plane,a,a
8310 REM SPEED Enemy,d,a
8320 PRINT INK 2;: REM COLOUR Bomb
8330 PRINT INK 1;: REM COLOUR Enemy
8340 LET a=7: REM VECTOR Bomb,a
8350 LET a=4: REM VECTOR Plane,a
8360 LET a=12: REM VECTOR Enemy,a
8370 FOR c=3 TO 13 STEP 10
8380 FOR a=0 TO 500 STEP 10
8390 LET b=5: LET d=80
8400 REM SOUND b,c,d,a
8410 NEXT a: NEXT c
8420 PAUSE 100
8430 BEEP .2,-12: BEEP .2,-10: BEEP .2,-8: BEEP .2,-12: BEEP .2,-12: BEEP .2,-10: BEEP .2,-8: BEEP .2,-7: BEEP .2,-5: BEEP .2,-5: BEEP .2,-8: BEEP .2,-7: BEEP .2,-5: BEEP .3,-5
8440 PAUSE 30
8450 FOR a=0 TO 7: PAPER a
8460 INK 9: PRINT PAPER a-1+8*(a=0); INK 8;: REM REPLACE
8470 LET b=40: LET c=5: LET d=0: LET e=90+a
8480 REM SOUND b,c,d,e
8490 NEXT a: PAPER 7: INK 0
8500 LET a$="   Press any key to continue   "
8510 PRINT #0;AT 1,0; BRIGHT 1;a$
8520 PAUSE 5: LET a$=a$(2 TO )+a$(1)
8530 IF INKEY$="" THEN GO TO 8510
8540 CLS
8550 PRINT AT 17,0; FLASH 1; BRIGHT 1;"SELECT LEVEL:"
8560 PRINT "0 - Easy"
8570 PRINT "1 - Medium"
8580 PRINT "2 - Hard"
8590 PRINT "3 - Very Hard"
8600 INPUT "Please Select:";Level
8610 IF Level<0 OR Level>3 OR Level<>INT Level THEN GO TO 8600
8615 REM ERASE Plane
8620 RETURN
9000 RESTORE
9010 FOR a=USR "a" TO USR "a"+47
9020 READ b: POKE a,b: NEXT a
9030 RETURN
9040 DATA 0,0,0,0,56,124,124,56
9050 DATA 255,153,153,255,255,153,153,255
9060 DATA 24,60,126,255,255,153,153,255
9070 DATA 0,152,145,159,223,153,153,255
9080 DATA 0,0,249,35,255,255,16,0
9090 DATA 0,0,159,196,255,255,4,0
9500 SAVE "Bomber" LINE 9990: SAVE "Data"CODE 61030,4338
9990 CLEAR 61029: LOAD ""CODE
9999 RUN
```

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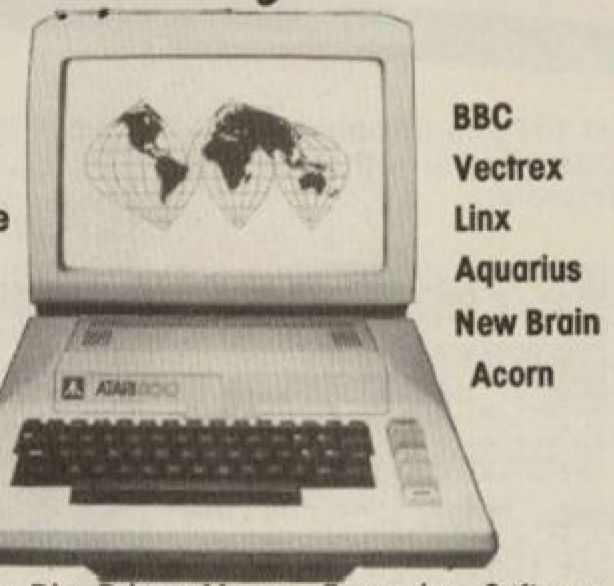
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Star chart

Tomb of Dracula

48K Spectrum:
Adventure:
K-Tel:
£6.95:

★★

The flip-side of the record company's first bid to break into micro software. A text adventure in which you collect silver stakes to arm yourself against the vampire. They can be traded for glimpses of a map leading to gold. The flip-side is called "It's Only Rock 'n' Roll But I like it." It is only written in Basic, and I did not like it.

Space Station Zebra

48K Spectrum:
Shoot-'em-up:
Beyond:
£6.95:

★★★

Coriolis sickness is the least of your problems on this space wheel. The screen display is an impressive view from the hub of the outer rim of the station. You have to spin the station and sparingly use your laser against alien intruders. I found myself going round in circles on this one.

De-Fusion

48K Spectrum
Adventure:
Lyndenhurst Ltd:
£5.50:

★★

A dotty scenario wherein Happy Larry rushes around a background of squares or paths, defusing bombs and collecting flags, avoiding skulls and crossbones, while a pair of Doc-Marten's attempt to crush him. Almost as good as the Blockman program we published in January 1984.

Royal Birkdale

48K Spectrum
Simulation:
Ocean:
£6.90:

★★★

A lovely opening graphic introduces a program which apparently duplicated the Royal Birkdale Championship Golf Course to a tee. You have to estimate the angle of drive and select strength of hit and allow for wind direction. You do not have to tip the caddy, either.

SOFTWARE Shortlist

Fighter Pilot

- *48K Spectrum:*
- *£7.95:*
- *Digital Integration:*

★★★★

THERE ARE OLD pilots and there are bold pilots, but there are no old bold pilots — unless they are flying a Spectrum flight simulator of course. Digital Integration's Fighter Pilot is very good indeed. Not only is there a comprehensive representation of the instrument panel of the McDonnell Douglas F-15 Eagle air superiority fighter, but also a good impression of the view from the cockpit. The green line of the horizon and the blue of the sky lurch and spin so convincingly that it is worth getting in a supply of brown paper bags before sitting down to play this one.

There is a Kempston AGF joystick option for this program, which probably renders it more enjoyable than pushing buttons. Not only do you get standard aircraft joystick controls but rudder controls, thrust and flaps can all be used to add subtlety of aerial manoeuvre. Cockpit view can be replaced by a map showing where you are. There are five options within the program: landing practice, flying training, blind landing, air-to-air combat practice, and finally air-to-air combat.

In the final option, you defend four airfields codenamed Base, Tango, Zulu and Delta. After scrambling from Base, you figure out where the enemy is by using your radar and flight computer. Having guessed his target for tonight, you fly an intercept vector. Visual contact occurs inside a mile radius of the hostile, at under 5,000 feet altitude. The enemy aircraft kicks off the engagement by manoeuvring to get a good attack position. Damage to your own aircraft is shown by a colour change of the aircraft symbol on your radar.

Instrumentation is represented in depth. The radar compass on the far left of the panel is used in combat mode to locate the enemy shown as a flashing dot moving around the aircraft symbol on the instrument. To find his altitude you have to select the flight computer. This is also used for landing guidance as well as combat. Other instruments on the simulator are the artificial horizon, airspeed indicator, altimeter, vertical speed indicator — VSI, this gives your rate of climb or descent — thrust indicator and instrument landing system.

The high degree of accuracy is only to be expected, since program author D K Marshall spent four years at Boscombe Down flying and evaluating aircraft from all over the world, and moved on to the Royal Aircraft Establishment at Farnborough to become a professional flight simulator programmer. Fighter Pilot certainly compares favourably with Micromart's Strike Attack, written by an RAF Phantom navigator, inasmuch as the latter does not have a view from the cockpit, just instrumentation. The two are complementary, however, in so far as one is dealing with air-to-air combat and the other with ground attack.

Atic Atac

- *48K Spectrum:*
- *£5.50:*
- *Ultimate Play the Game:*

★★★★

IF YOU HAVE heard Michael Jackson's *Thriller* album, and seen the video, you might like to play the game: Atic Atac. It is one of the spookiest, most action-packed, shoot-'em-uppiest programs yet to be seen on a Spectrum.

You are cast as the hero of the piece, and can choose roles. Your choice, knight, wizard or serf, determines which set of secret passages are open to you, the appearance of your computerised alter-ego, and weapons for zapping beasties with. Once this is done, and you have decided whether to use a joystick or the keyboard, you are beamed-down into the front room of a grand and spooky old house.



At this stage the best thing to do is to explore the house, finding your way around and memorising escape routes. But beware: the doors that guard the entraces to the rooms that you travel through, are liable to slam shut, without warning, leaving you trapped. When this happens, time marches on, your food supply situation, as indicated by the gradually devoured chicken on the right of the screen, diminishes, and

(continued on page 61)

THE TENSION MOUNTS, THE ADRENALIN FLOWS. THE ADVENTURE BEGINS...





ALCHEMIST Can you discover the secret of the 'Spell of Destruction' and defeat the Evil Warlock. Even with your amazing powers of transformation the outcome is still uncertain.

ZIP ZAP Encounter hoards of aliens as your runaway droid enters the various domains of ever increasing intelligent attackers. Heart stopping tension and supersmooth animation.







STONKERS You are poised on the very brink of battle. As Commanding General every decision is yours. Will your strategy enable you to capture your objectives? Will victory be yours.

ZZOOM You are flying the fastest most deadly machine yet devised by man. If your resolve begins to weaken, remember, the fate of an entire race depends upon the outcome of your mission.....will you succeed?

Imagine ..the name of the game

Imagine Software Limited,
5 Sir Thomas Street, Liverpool, Merseyside L1 6BW.
Dealer Enquiries Contact: Colin Stokes on 051-236 8100 (20 lines).

Star★chart

Space Raiders

Dragon 32:
Shoot-'em-up:
Microdeal:
£8.00:

★★

There is absolutely no need for software houses to feel ashamed about foisting old games like Space Invaders on the public under a different *nom-de-guerre*. I mean, nobody's going to buy it without playing it first, are they?

Glaxxons

Dragon 32:
Shoot-'em-up
Microdeal:
£8.00:

★★★

More nostalgia from Microdeal. It is funny how if you say Galaxians fast you get Glaxxons. The same is almost true of the actual game. Given the limitations of the Dragon, this is a good hi-res shoot-'em-up. Traditionalists will love it.

Jet Pac

Vic-20 (+8K expansion)
Shoot-'em-up
Ultimate Play The Game
£5.50:

★★

A difficult-to-play implementation of the game originally designed for the Spectrum. The idea is to assemble your rocket module in three stages and then fuel it with pods which magically appear on platforms. You do this with "the very latest Hydrovac Jet Pac". You defend yourself from marauding aliens with a laser phaser and extra points can be earned by picking up any valuables you might come across.

Space Joust

Vic-20 (unexpanded)
Shoot-'em-up
Software Projects
£5.95:

★★

Wave after wave of enemy spacecraft which look like bouncing eggs must be destroyed. They have no weapons and neither do you. The only way to destroy them is to hit them from above due to a flaw in their design. The problem is that the same weakness is present in your ship so make sure that the aliens don't sneak above you.

(continued from page 59)

worst of all, the hauntaing begins.

All manner of foul creatures appear to haunt you, they look like they have escaped from the chamber of horrors. By zapping them with your trusty weapon, you send them packing, back to the other side from whence they came, but more to the point, you score.

Atic Atac combines elements of adventure with those of arcade games in a very original way. You need the red key to pass through a red door and must eat food to stop yourself from passing away prematurely due to hunger. The layout of the house is consitent, and so as you play the game more and more, you begin to find your way around. A number of real terrors, such as Frankenstein's Monster, Dracula and the Devil all appear and can give you quite a hard time.

The ultimate aim in Atic Atac is to find the key to the front door, and to escape to freedom, presumably this happens only when you have explored every room in the building, which is not easy, but becomes progressively more likely the longer you practise. When the third re-incarnation of yourself on screen finally bites the dust, your final score is displayed along with an indication of the percentage of the house which you actually visited. All in all, Atic Atac is one of the most impressive games I have yet seen on the Spectrum, but do not play it after midnight.

SOFTWARE Shortlist

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YOUR SCORE IS 3
YOU ARE IN GREAT TROUBLE IF YOU ARE
REALLY INTERESTED IN ATTRACTING A
NEW MATE AND RETAINING THEM FOR ANY
LENGTH OF TIME. IF YOU ALREADY HAVE
A PARTNER DON'T BE SURPRISED IF YOU
SEE THEM DISAPPEARING OVER THE
HORIZON. YOU REALLY ARE A SOCIALLY
INCOMPETENT, BOORISH PERSON WHO
WOULD BE DIFFICULT TO LIVE WITH IN
YOUR PRESENT STATE OF IGNORANCE.
SEEK HELP IMMEDIATELY OR BECOME A
HERMIT.
```

The Dating Game

- *BBC and Electron*
- *£12.60*
- *Acornsoft*



If you feel your love life is somewhat lacklustre Acornsoft's The Dating Game could be the remedy. Designed by social psychologist Dr Glenn Wilson it provides four programs to assess your capacities and preferences as a lover. Each sets a number of multiple choice questions and then delivers a diagnosis.

The first test requires at least two people to participate and gives an assessment of their compatibility. If more than two people join in it will pair off the couples it thinks are best suited to each other. There is an option for saving the data.

The three other programs test respectively love styles, preferred relationships, and dating skills. Love Style, for example, assesses you on three scales, "fanciful versus practical", "serious versus playful" and "cool versus practical". Dating Skills examines your ability to find a mate by asking such questions as "what do you expect from a party?",

It does not really matter how seriously you take the tests. They have the same appeal as horoscopes and personality assessments given in magazines. Dr Glenn Wilson makes various claims about the tests along the lines of "research by social psychologists has indentified three major dimensions of loving . . .". But these you can take with a hefty pinch of salt while still enjoying the programs.

The Dating Game makes a refreshing change from the standard arcade-style fare.

Urban Upstart

- *48K Spectrum:*
- *£6.50:*
- *Richard Shepherd Software:*

★★★

From the fridge full of lager to the juvenile delinquents' detention cell, Scarthorpe is the town where no-one goes and that even fewer people get away from. It makes Skelmersdale look like Las Vegas. Kids here think the UK Subs are a middle-of-the-road band, and that Joy Division were too flippant.

This is an adventure game, of course, since this is Richard Shepherd's speciality and is a bit more lively than some of its predecessors with good use of simple graphics. So if you are the sort of person who would like to give Elrond a punch on the nose, and if you think Gandalf needs a haircut, this is the game for you. The goal is to escape from Scarthorpe by night. Since this is the sort of town where you get mugged coming out of the dole office, it is no easy number just trying to bring the milk in, let alone walk down the street.

My first mistake in playing this game was to drink the can of lager in the icebox. I ended up in hospital. I stole a white coat, but ended up in the police station. As you can see, Scarthorpe really is a dead-end town.

The program accepts a wide range of commands and is reasonably user-friendly. It is a pleasant, or rather, unpleasant change from the Dungeons and Dragons world of games like the Hobbit. A computer game with a social conscience! Play it and see.

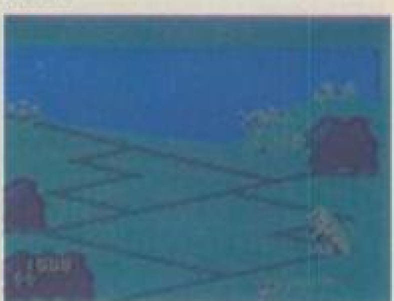
Ugh!

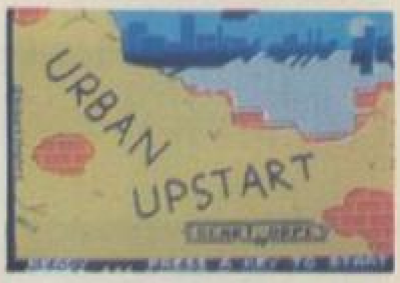
- *Dragon 32*
- *£6.95*
- *Softek International*



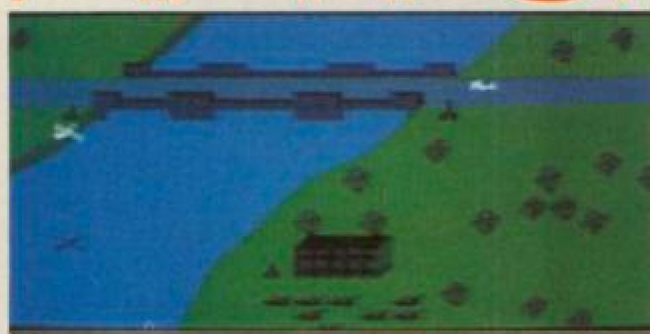
The Ice Age cometh and your intrepid caveman Ugh needs an adequate supply of victuals to see him through the long winter months. What better than to stock up with pterodactyl eggs. However Pterry, the eggs' dad, is not impressed and attempts to squash Ugh by swooping down and bombarding him with rocks. They are relatively easy to avoid but when Rex the tyrannosaurus arrives on the scene things can get decidedly nasty. Ugh's only defence is a spear. Since he can only carry one spear at a time he must return to his cave if he wants another.

There are three screens with progressively more difficult paths for Ugh to follow and 16 skill levels are built into the game. Control is by joystick or keys. Graphics and animation are good and this essentially simple game is mildly addictive. One further good point is that you do not have to listen to the Death March every time Ugh gets killed.





ATARI GAMES



Blue Max *approaches his target*



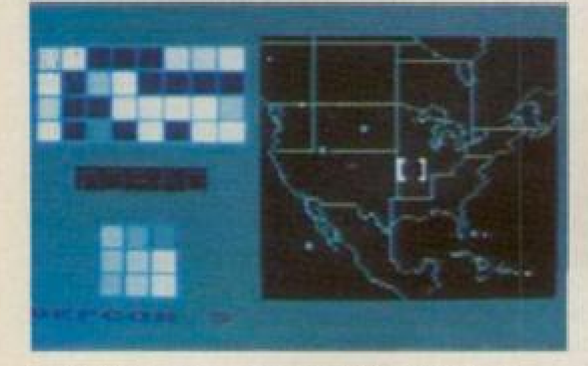
bombs away, direct hit



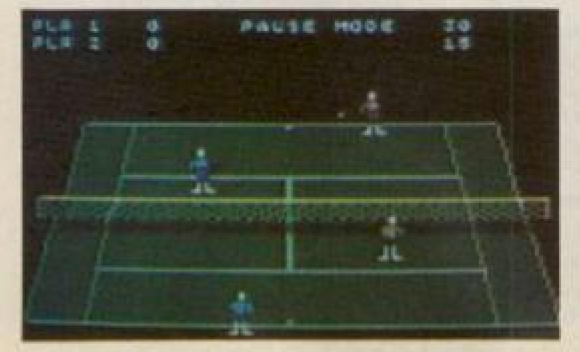
bridge destroyed, next target please.



Below: **Computer War**, *the War Games game.*



Below: **Tennis**, *pricier than the real thing.*



You don't have to be an Atari fanatic to admit that it has some of the best-looking games, but with prices up to £25 Meirion Jones asks are they worth the money?

EVEN THE SNAPPIEST games around — even for the Atari — are a bit like Hollywood B movies from the 1950's when car chases, Ronald Reagan and the Cold War were all still bright young things.

However exciting the action is, however good the graphics, the ideas behind the games are pretty shallow — races, chases, heroic fighter pilots taking on enemy air forces and alien battle fleets single-handed, man rescues heroine from the arms of a villain and so on.

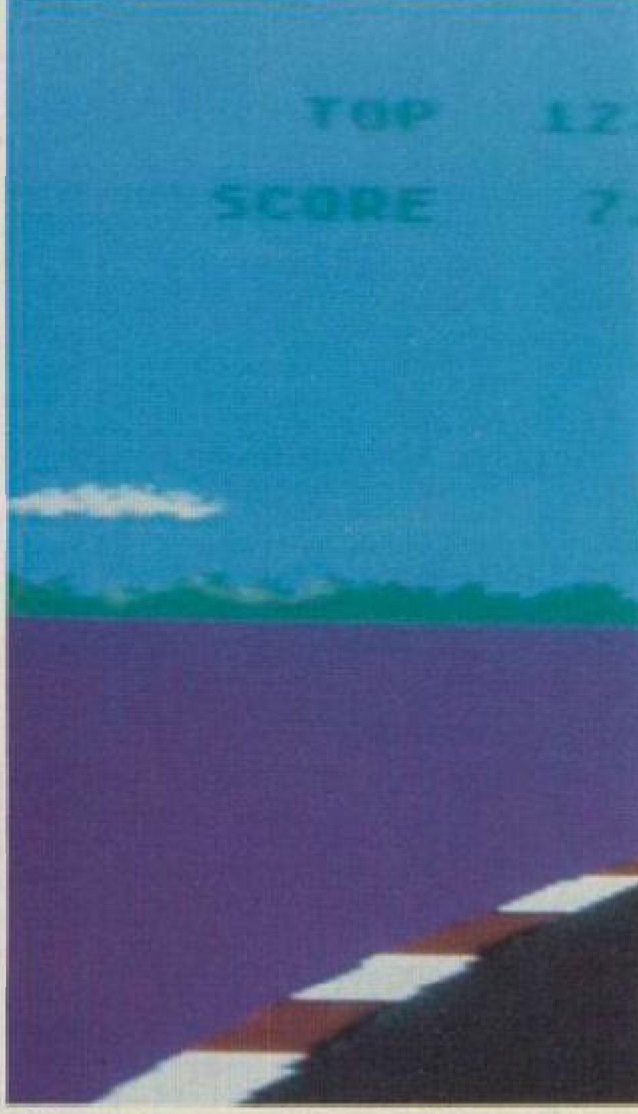
If you wanted to sum up the whole mood in one you would come up with a game with a name like "Zap the red weirdos from Mars". Unfortunately it's already been done with a cartridge for the Atari video game machine called "Communist Mutants from Outer Space". But you cannot palm off that sort of rubbish on Atari home computers users. Instead they can buy Lone Raider which describes itself as "the first UK produced all action game from Atari".

It is not a particularly bad game — there are three frames of action starting with a simple one-dimensional dodge the Daleks which takes a couple of minutes to master and ending with a Frogger variant which is quite fun at first but soon palls. If you had paid £5 or £6 for it — the going rate for a good Spectrum program you would not be too disappointed. Although there must be 30 better programs than this for the Sinclair in that price range.

The trouble is that Atari expect people to pay £15 for the Lone Raider cassette — the sort of money that buys you outstanding programs like Scrabble on the Spectrum. If this is the best that Atari can find in Britain the 400 and 800 cannot have encouraged many owners to become games programmers.

Commodore can point to their British written International Soccer for the 64 — still the most outstanding games program available on a home computer — as evidence of the strength of software support for their machines in Britain. All the best games for the Atari including Tennis, Pole Position and Blue Max come from the other side of the Atlantic.

Pole Position is most impressive for its faithfulness to the arcade original as you can see from the big colour screen shot which dominates this spread. You could never in a thousand years produce displays of this quality on most other home computers. You are alone on the grid at the start and you have to complete your first lap in a fast time if you want to qualify for the next race.



You accelerate smoothly up to 105 mph, pull the joystick back to go into higher gear and start weaving your way through the other cars on the track touching speeds of 195 mph at times. If you hit another car you crash where you are but after the flames have gone out you start again from where you where remembering of course to change down the gears to get maximum acceleration from rest.

With a little practice you learn to get through most of the corners at very near full speed with a touch of the brakes — the fire button — or by sliding through sideways with a good tyre squeal. There is only one corner where you might need to change down or deliberately slow down by cutting across the grass to get round.

You slow up very quickly if you go off the track — instantaneously if you hit a trackside hoarding. With skill you should be able to get round fast enough to qualify.

The screen tells you which of the eight positions on the grid you have earned. In number eight you will find seven cars ahead of you on the starting grid but even if you get pole position you will find youself overtaking cars which logically cannot be in front of you. You can choose how many laps you want to race before you qualify.

Pole Position makes all other car racing games look second rate.

I found Blue Max even more appealing even though it is a shoot-'em-up supposedly based on the First World War, but full of strange inconsistencies. You have a steadily scrolling almost plan view of the battlefield which you fly over in your biplane bombing the strafing ground targets and shooting down enemy aircraft.



You might have thought that the Blue Max would be flying for the Germans — but not a bit of it. According to the leaflet which comes with the game he is flying for the RAF — which is strange because at the date at which the game is supposed to be set there was no RAF, only the Royal Flying Corps. But none of this detracts from the appeal of trying to hit as many bridges and block houses as possible.

Hitting enemy planes is more difficult. If you get to the same height as your target the bottom of the screen goes blue and you open fire with a real chance of shooting the enemy down. Anti-aircraft fire can disable your guns and bombs, cause fuel leaks and affect your manouverability. This last is particularly import when you come in to land at the next airstrip.

Even the more thoughtful stategy games like Eastern Front are a little worrying. Eastern Front has been available on cassette from specialist shops for some time but has only recently become easily available since Atari released it on cartridge with some improvements to the original.

You play the part of Nazi Germany. The scene opens on the eve of Operation Barbarossa, the invasion of the Soviet Union in World War II, which was to leave 20 million Russians dead. The game itself is absorbing and intense. You push your forces forward, tank regiments bursting through the Russian lines and infantry units mopping up survivors behind.

You program all your units individually with up to eight moves then push the start button and watch their progress against the reds. After a couple of hours of play at the Advanced level, which was the only level you could play at with the old cassette-based Eastern Front, you will probably have taken Leningrad and perhaps Stalingrad and be on the fringes of Moscow, but Russian reinforcements will eventually force you back.

If you want to learn how to play the game there are now two easier levels together with a super difficult Expert level which requires you to tell each unit whether you want it to march, fight or stand its ground as well as where you want it to go.

If you just think of it as a game Eastern Front is the best wargame simulation available on a home computer, but perhaps a Russion might see if differently.

Computer War — based on the film War Games attempts to be more ideologically sound. You are defending America from attack by cruise missiles — well the guidance systems have not always worked very well in tests — and you see them coming in on a big map of the country as white dots.

You move a cursor over the dot and move in to a straight forward shoot-'em-up. Echoing the advertising for the film the computer asks is this a game or is this for real. I must admit that when I feel a sudden uncontrollable urge to save the country from nuclear attack I reach for Missile Command.

Dig-Dug is a good implementation of the arcade game. You mine your way around the screen looking for vegetables pursued by the usual motley collection of dragons, monsters and ghosts. But at least the method of disposing of your enemies shows a little more imagination than the usual "Press red fire button".

Tennis will appeal to armchair John McEnroes because for the price — £25 — anyone genuinely interested in the game could buy a racket and half a dozen tennis balls and still have enough left over to go and watch the first day of Wimbledon. You can choose doubles or singles with or without the computer taking part.

It is quite easy to get your player to the ball and make a shot by pressing the fire button but difficult to direct it. You have to get to the ball early and then pull the joystick towards the part of the court where you want the ball to go.

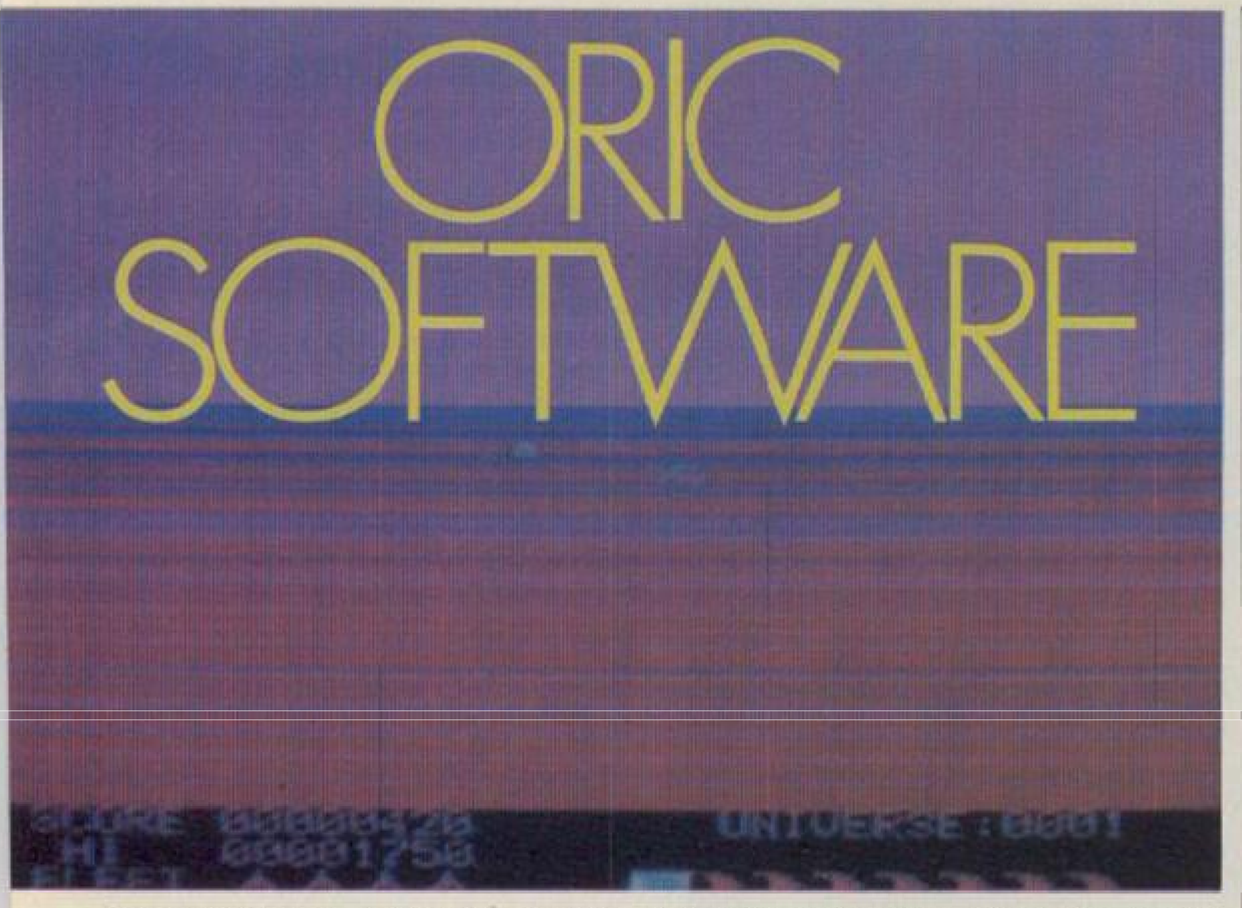
Games for the Atari are so expensive that they have to be more than just good fun for a few days. The most hopeful sign for the future is that Zaxxon — the ultimate space shoot-'em-up loosely based on the low level space chase across the surface of the planet in Star Wars is coming down in price to £15.

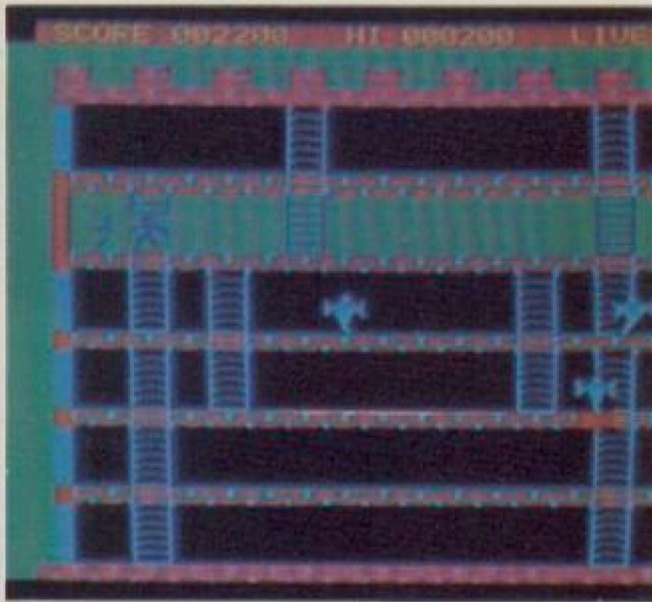
That makes Lone Raider look particularly overpriced — especially when you rember that Zaxxon was voted Game of the year in America in 1983. ■

Dig-Dug's *way of dealing with dragons is to undermine a rock and then sidestep.*









Above: Dracula's Revenge from Softek. Left: Loki from Joe the Lion. Above right: Oricmunch from Tansoft. Far right: Ultima Zone from Tansoft.

Paul Bond, with cotton wool firmly planted in his ears, learns the secret of immortality.

PING, ZAP, SHOOT and Explode — the quasi-onomatopoeia of Oric Basic is well-known. No secret either is the clamorous sound of the AY-3-8912 sound chip which has three channels capable of producing a broad range of noises. Anyone with the temerity to play a shoot-'em-up game on the Oric had better be prepared for the robust sound effects.

With Tansoft's Defence Force, however, you do get an option; it is possible to play a silent game. It is a little unnerving, though, when the action stops to perform a non-existent sound attack. Silent games on the Oric are just not the same. You do not have quite the same "feel" to the game.

Defence Force is good solid traditional fare — once upon a time I might have said something about blasting off into the unknown to meet strange beautiful exotic beings and disintegrate them, but, alas, they are only too familiar and one's first instinct is to greet them like old friends. It is of course a fallacious response, for their reply is invariably to leave you spinning in a low orbit with your solar panels blown away, before the second wave arrives and reduces you to a name carved on the shields of honour at Starflet Academy.

A Defender-style game, it is your job to keep the pathetic remnants of the human race, who are sitting dazed at the bottom of the screen like extras from *The Day After,* from being kidnapped by grisly off-world marauders. There are 16 different varieties of these galactic grotesques, and your spacecraft is designed to fire in the direction it is pointing in, in order to do away with them. The vulturae are birdlike creatures who do the kidnapping. If they get to the top of the screen they mutate into assassins — should all the humans be captured the game transfers to the astral plane and the entire enemy turns into wraiths.

A star map on the top right-hand side of the screen gives you a long range plan view of hostiles in the area. The game has all the little touches which give a presentation sophistication: a hall of fame, a beginner's option as well as the aforementioned silent option. More grimly, there is even a suicide option — press zero if things are going badly.

One of the things that made me feel suicidal during this review was getting things to load on the Oric, although once I got hold of a tape-recorder that would work with it, problems were few. Most software houses realise the problems presented by the Oric's fast rate of output, and include fast and slow versions on their tapes. Inputting data at the slow rate means waiting about eight times longer than loading at the normal rate. This can be tedious where some of the longer and more complex programs are concerned — and of course, this is just where it is most essential.

Oric Galaxians by Gordon Russell, produced by Softek finds us still lost in space. As connoisseurs will appreciate, Galaxians, being an early descendant of Space Invaders means that your ship is anchored at the bottom of the screen blasting away at descending aliens not unlike the vulturae of the preceding program. Clear one attack wave and another appears swooping more and more frequently. As your prowess improves, so does theirs. You score more the closer the alien gets to you — as long as you destroy it. There is an extra life every 10,000 points to a maximum of five lives.

Again, good standard stuff, well-suited to the Oric's sound and graphic capabilities. I found this game strangely hypnotic.

Dinky Kong — crazy name, crazy game! This Severn Software offering drags us back from space. Your lovely girlfriend has gone off with an ape, not entirely of her own volition it would seem, or at any rate she has had second thoughts. The course of true love never runs smoothly, but it is particularly rough round here since the outrageous orang-utang is rolling barrels and fireballs at you. You are trying to climb up ladders from platform to platform to rescue her.

Yes, it's Donkey Kong, a pale shadow of its former self. What is missing from this one — sadly in view of the capabilities of the AY-3-8912 — is music. There are nine different screens but the Atari implementation of this arcade favourite is much stronger.

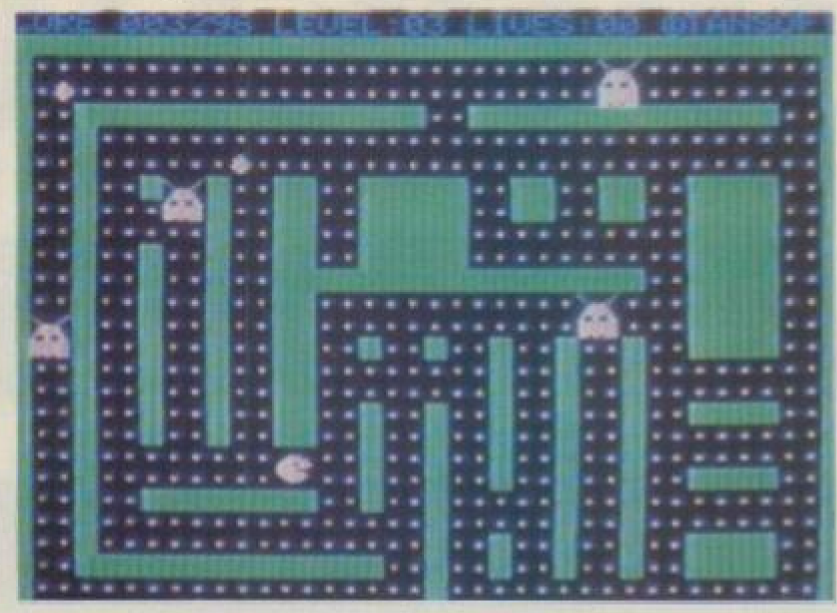
As it turns out, a Kong by any other name can also be a Dracula. Dracula's Revenge, from Softek by Steven Chapman is a good example of giving an old game structure that vital spark of originality.

You, as Fearless Freddy the Friar, receive a papal edict telling you to clear up Transylvania. Instead of telling him it is a load of bull, and that you do not want to be a friar who as had his chips, you gamely jump out of the frying pan into the fire.

The screen shows a side-view of one of Count Dracula's unholy hang-outs. It is a castle with several floors and ladders connecting *a la* Kong. It is full of ghosts and werewolves and, at the more difficult levels of the game, vampires, and they are not doing much to increase local property values. What makes this game so tricky is you can only dispose of certain ghouls with certain tools — and at the right time of day. They are all powerful at night except for the werewolves who can be dispatched with a silver bullet regardless of Transylvanian local time.

The time of day is indicated by the colour surrounding the framework of the castle. The creatures of the night cannot face daylight, so as long as the sun is up, all you have to do is run to one end of the floor and open a window. The ghosts are exorcised by the influx of yellow or green daylight — vampires are hardier and can only be stopped by yellow light.

Do not rely on mere daylight where werewolves are concerned, or you will find out what a tin of Pal feels like. Creepy music plays throughout this game and every so often the legend appears on the screen: 'Castle 07 sanctified' — or however many you have cleaned up. To move around the screen you





use the cursor keys — quaintly referred to as "curser keys" in the documentation — and use the space bar to, fire the bullets.

Still in a gothic vein, you are outside a tall gloomy building. There is a door to the north. There are trees all around. A closed door with a brass door knocker and a bell push. All the classic symptoms of an adventure game and, yes, it is Oric House of Death from Tansoft. Unfortunately it is a text adventure game, no graphics as in the Hobbit, and it did not really fire my imagination in the early stages. But I only got as far as the Developing Room.

Is it a Pac-Man? No, it is an Oricmunch and the object of the game is to move your Oricmuncher round various different mazes eating all the power pills in your path. Familiar? I often wonder if whoever it was thought up the original game ever said to himself "Thar's gold in them thar pills!"

For every game you have to key in the number of the level you wish to start at. Level 1 is easy and 9 is difficult. The number increases every time you clear a maze and Tansoft maintains that there is no limit to the number you can reach. Apparently 28 is respectable.

Compared to similar games I have played — for example on the BBC Micro, there is Acornsoft's Snapper — this seemed a trifle gluey. There appear to be nine different screens and the action accelerates as you progress from level to level. Perhaps I am just not enough of a maze freak to keep up the concentration. Another thing which speeds up the game is eating a Bugmonster, which you can do in the usual way after you have engulfed a flashing dot, or booster pill. If two Bugmonsters get eaten, the remainder of the delinquent protoplasmic blobs seemed to get pretty stirred up about it.

Also stirred up about something are the Ultra, an evil race of mutant aliens, who challenged me to do a battle to the death in outer space in this startlingly unoriginal scenario from Personal Software Services. The aliens travel horizontally instead of vertically, but you still have to shoot them.

There are 16 different screens, and a nice touch insofar as you can select the level of sound: press 1 for no sound effects, press 2 for quiet sound effects, press 3 for a surprise visit from the Noise Abatement Society. Another stylish embellishment is having two sets of control keys to select. A competent enough use of the Oric's facilities, I still can not feel I would write home to Tau Ceti about this one.

Hopefully more than 11 light years away is one of the roughest places in space — the Ultima Zone, immortalised in a zappy trilogy from Tansoft. The three sections of this computerised shock corridor are Battlezone, the Trap and Orbit Runner. In Battlezone, you are presented with a screen, the bottom of which is divided into three sections. You do battle with the Walkons *a la* Space Invaders.

As you destroy the Walkons they disintegrate into fireballs, releasing the ebulliently destructive bouncing brunes, which are caged in three sections at the based of the screen. You have to destroy all the brunes which are pretty nifty, before moving on to the second part of the game — The Trap. Here you use your laser base to pump power into a presumably disabled Henk class battle cruiser.

It shoots sideways as you shoot up into it. With this rather *ad hoc* Heath Robinson method you have to take out three bouncers before you get to the final tricky stage, Orbit Runner. This is a kind of Frogger where you have to pilot your Sheamus-2 missile through four streams of orbiting bombs to destroy the Walkon spy satellite. Each satellite is worth 75 points. If you manage to get them all a bonus like is awarded. This is probably the best of the bunch from Tansoft, and a thoroughly enjoyable and satisfying sequence of games.

Quark 3D Invaders from Quark Data is a truly ingenious enhancement of the Space Invader theme: your laser base moves about on a slightly slanted 4 by 8 grid at the bottom of the screen. You have to be on the right line to hit the similarly slanted legion of space invaders who are creeping down towards you dropping bombs in their accustomed boorish and unsociable manner. Every so often a mystery object looking suspiciously like a flying saucer zooms across the screen and you can augment your score considerably by destabilising its atomic structure with a well placed blast of light amplified by stimulated emission of radiation. Yes, that is what laser stands for — never spell it with a 'z'.

The copy of Acheron's Rage from Softek that I looked at had a rather strange bug: I was rendered immortal. Regardless of how many ergs I took from passing metagalactic malcontents, I never lost a life. Why Acheron is taking his revenge or who he is is never made clear. Apparently you have blundered into a sector that the warships of the Gor are particularly hot on. In this Asteroids based game, you revolve slowly and can move about the screen taking advantage of a centrally placed grid to shield you from enemy fire. It might be a good game, but like most invulnerable beings I became rather blasé about the whole show.

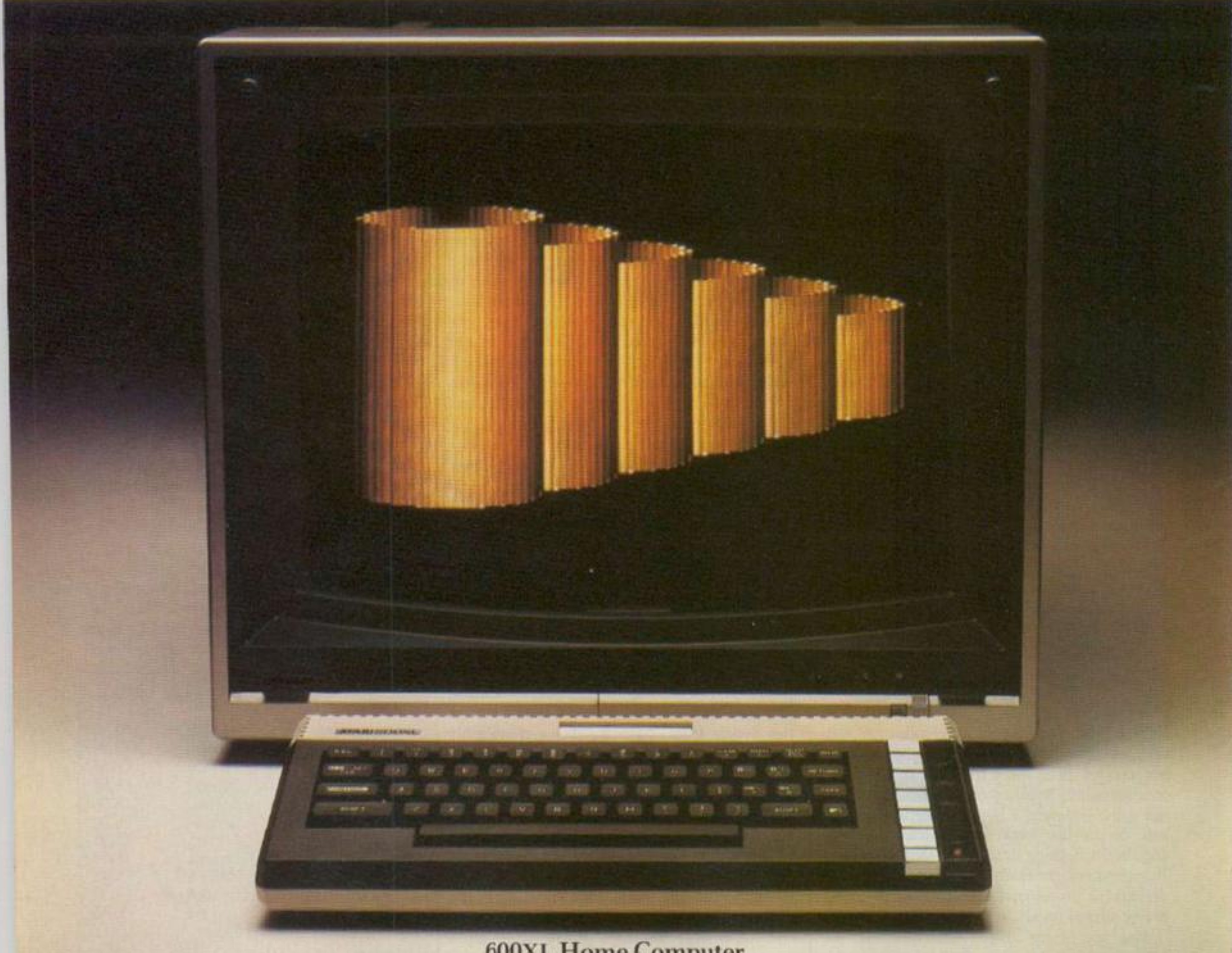
Finally, I had a look at a pre-production copy of Loki from Joe the Lion. Loki is a Scandinavian god, and you should never look a gift Norse in the mouth. Loki was the trickster among the Asgard bunch and did jolly witty things like throwing mistletoe at Balder, which is like chucking Kryptonite at Superman. Needless to say he was not very popular with the other gods. All this is if the truth be told, totally irrelevant to the actual game which is an out-and-out shoot-'em-up.

During the first waves you whizz across a red-gold desert shooting at nameless things coming towards you: later on you end up in space, looping and bunting in an impressive three-dimensional starfield, still shooting at said nameless things. The whole thing is a little like trying to drive down the M1 in the wrong lane at 130 miles per hour.

Game	Company	Price
Defence Force	Tansoft	£7.95
Oricmunch	Tansoft	£7.95
Ultima Zone	Tansoft	£8.50
House of Death	Tansoft	£9.99
Oric Galaxians	Softek	£6.95
Dracula's Revenge	Softek	£6.95
Acheron's Rage	Softek	£6.95
Dinky Kong	Severn	£6.95
The Ultra	PSS	£6.95
Quark 3D	Quark Data	£7.50
Loki	Joe the Lion	£6.45

Tansoft
Units 1 & 2, Techno Park, Newmarket Road, Cambs.
Softek
329 Croxtead Road, London, SE24.
Severn Software
5 School Crescent, Lydney, Glos.
PSS
452 Stoney Stanton Road, Coventry, CV6 5DG.
Quark Data
3-5 Wood Street, Swindon, Wilts.
Joe the Lion
213-215 Market Street Hyde, Cheshire.

As your expe
so can your



600XL Home Computer.

Whatever you want your home computer to do, the ATARI 600XL™ can do it.

ATARI 600XL product specifications.

Colour capabilities: 16 colours and 16 intensities. 256 shades.

Memory: 16K RAM expandable to 64K with memory expansion module. 24K ROM operating system including ATARI BASIC programming language.

Sound: 4 independent sound synthesisers. Each with a 3½ octave range.

Display: 11 graphic modes. 5 text modes. Up to 320 x 192 resolution. Maximum text display 24 lines by 40 columns.

Special ATARI integrated circuits: GTIA for graphics display. POKEY for sound and controller ports. ANTIC for screen control and I/O.

CPU: 6502C microprocessor. 0.56 microsecond cycle. 1.8 Mhz.

Extended graphics functions: High resolution graphics. Multi-coloured character set. Software screen switching. Multiple redefined character sets. Player missile (sprite) graphics. Fine screen scrolling. Changeable colour registers. Smooth character movement. Simple colour animation facilities.

Programming features: Built in ATARI BASIC programming language plus 8 other languages. HELP key will provide additional information and menu screens. Syntax checking on entry.

Input/Output: External processor bus for expansion with memory and peripherals. 2 controller ports. Serial I/O connector. Monitor output.

Software: Over 1000 items of software available including self teaching programs with unique voice over. Education. Home management. Programming aids. Atari user written programs (APX). And Atari's famous entertainment software.

rience grows
Atari 600XL.



1. Program Recorder.



2. 64K Memory Module.



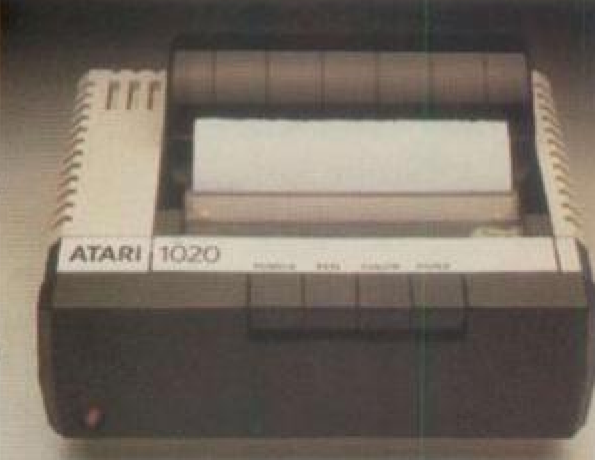
3. Touch Tablet.



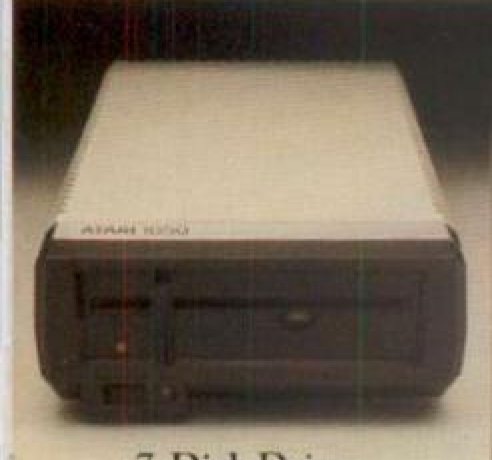
4. Trak Ball™ Controller.



5. Super Joysticks.



6. Colour Printer.



7. Disk Drive.



8. 80 Column Dot Matrix Printer.



9. Letter Quality Printer.

These peripherals will be available soon:

1. ATARI 1010™ Program Recorder for low cost storage and retrieval capability. Data transmission 600 baud. Storage capability 100K bytes on a 60 minute cassette. Track configuration 4 track, 2 channels (digital and audio). Auto record/playback/pause control.

2. ATARI 64K Memory Module gives the 600XL a massive 64K RAM.

3. ATARI Touch Tablet enables you to paint pictures and draw diagrams, with the touch of a stylus.

4. ATARI Trak Ball™ Controller enables cursor movement in any direction; adds to the pleasure of Atari games.

5. ATARI Super Joysticks. Gives you a greater competitive edge over your games.

6. ATARI 1020™ Colour Printer plotter. Four colour graphic print capability. 40 column. 10 characters per second. 5, 10 and 20 characters per inch.

7. ATARI 1050™ Dual Density Disk Drive. 5¼ inch disks holding 127K randomly accessible bytes provides both expansion and flexibility for your 600XL system with DOS III.

8. ATARI 1025™ 80 Column Dot Matrix Printer prints 5, 10 or 16.5 characters per inch. 40 characters per second. Ideal for program listings, financial reports, etc.

9. ATARI 1027™ Letter Quality Printer for word processing letters in professional type.

If you'd like to know more about the ATARI 600XL, write to Atari International (UK) Inc., P.O. Box 407, Blackhorse Road, London SE8 5JH and we'll send you all the details.

The new Atari XL home computer system. ATARI®

COLECO ADAM









Rock-steady display and stunning graphics from Buck Rogers for the Adam.

THE COLECO ADAM is a word processor which can be used to run business programs and also the wide range of Coleco games cartridges. The Adam is currently sold in the States at $700 but the final UK price may be as much as £700.

The Adam will initially appear in March as an upgrade to the Coleco games machine. A stand alone version is expected to appear in August/September.

There are three separate hardware modules — A keyboard, a memory unit and a printer. The printer unit houses the power supply which drives the whole system.

The keyboard has a very nice feel to it with sensible positioning of keys which automatically repeat when held down. The meaning of the black 'smart/function' keys is provided on screen in word processor mode, other key legends also refer to word processing functions.

One of the games paddles may be placed in a carrier to the right of the keyboard and can be used as a numeric keypad. The logic of this will be appreciated when entering Basic programs, there is much less need for non typists to use the shift key and therefore less likelyhood of typing the wrong meaning on the normal dual function numeric keys.

The memory unit houses the tape cartridge drive, the memory, processors and expansion ports.

The tape drive units are inexpensive digital drives that use Coleco formatted digital cassettes. Each cassette is capable of holding 500K of formatted data.

There is only one drive supplied although the capacity exists for two. The use of cassettes removes the problem of the special storage requirements for the Microdrive cartridges but is likely to lead to users inserting ordinary cassettes which obviously are not only unformatted, but of inadequate quality, and then complaining that they do not work.

The memory consists of 80K RAM — 16K video RAM and 64K general. On switching on the normal mode is word processing which is housed in ROM. Under these conditions, the user has the main memory as a working store and uses the cassette drives for mass storage of text.

The Adam does not have a resident Basic interpreter; that is loaded from tape which leaves a little over 220 blocks free of tape storage. PRINT FRE(X) shows the amount of RAM available as 26K which indicates that perhaps the ROM is masking a large slice of RAM. Masked memory is usually only available to data storage.

There is expected to be a 64K expansion board providing a total of 144K memory. How much will actually be usable to Basic depends to a large extent on the provision of a suitable bank memory switching mechanism.



The main unit has three expansion board slots under the top cover and a cartridge port at the top right of the main unit. And edge connector is provided at the side to the system bus as are connectors for two paddle controllers. At the rear are TV and video connections and finally the Adamnet connector which allows communication between each unit.

The bi-directional daisywheel printer uses standard Diablo cartridge ribbons and wheels. Like other prints of this type, the quality is paid for interms of speed and noise. It is very high quality print at a rather noisy 120 char/min.

A tractor feed is planned to enable fan-fold



Word processing: Adam's serious side

paper to be used, especially useful for the sticky address labels.

One point which should also be remembered is that daisywheel printers besides producing wonderful text are not suitable for producing the usual range of business type graphics charts. Normally this would present no problems, but until a Centronics or RS-232 interface is produced there will be difficulties.

The Adam requires a television to complete the system. This can be any domestic television as the resolution requirements are no more than the normal teletext transmissions.

The restriction of the screen display to 40 characters is no great loss. Working with 80 characters/line for any length of time requires the use of a good professional colour monitor which would increase the initial cost significantly. The display provides a paper cursor at the top of the screen which shows exactly where the character will appear on the page and that is all that is needed.

The display was extremely stable with no dot crawl. Generally the games machines seem to have developed very much better displays than computers.

The Adam has the capability of running cartridge and tape based software, I would have preferred the Basic to be in cartridge and not tape. It might have been felt that this would be too similar to Atari, but it would provide instant access to Basic.

There are two switches, one either side of the cartridge port which would have enabled the user to conveniently initialise word processing and Basic.

The Adam is foremost a word processor, and is in wp mode on switch-on. This function is menu driven and very convenient for the occassional user.

There is a reasonably comprehensive set of functions available including block search with multiple deletes and changes. A window is provided to enable the user to continually view the sector that is currently being typed in simulated 80 column mode. The page cursor

(continued on page 71)



(continued from page 69)

at the top of the screen is adequate but it is always wise to provide extra facilities.

The format of the print can be altered in terms of tabs, line spacing and characters per line and the finished document saved on the digital cassette drive.

The ink and paper screen colours can be altered to suit the user which is a very useful facility and the Adam will also automatically fold text in word processor mode. If the current word exceeds the 40 character line, the whole word is written on the next line.

Basic lacks structure

I would expect an enhanced version of the Basic at some stage as this implementation lacks good structure. But considering the market that the machine is aimed at, it is a more than adequate implementation.

The speed of the Adam at least three times faster than the Spectrum, that puts it on a par with all but the BBC's of the computing world.

The error messages are fairly comprehensive and with a good editor, enabled corrections to be made to erroneous data quite quickly. Each line is checked on entry for syntax which is unfortunately countered by the fact that the interpreter is space sensitive.

In text mode, there appeared to be 31 characters/line which indicates that Basic uses a 9 byte wide character and with 40 characters/line in wp, a 7 byte wide character. The maximum resolution of the display is 280 by 192, the Adam also supports 32 sprites and has a capability of displaying 16 colours.

I could find no sound facilities in the Basic command set, yet there is a very good sound capability as demonstrated in the games cartridges.

The Coleco Adam can run the Coleco range of games software. These are very high quality arcade type games with extemely good graphics.

There were three manuals available — Getting started, Programming with Basic and Typing with Adam. They were produced about the time of the Chicago Fair launch and in the case of the Basic documentation, did not represent the true performance of the Adam.

As the Adam is now available in the States, proper documentation should now be ready. By the time it comes to the UK there will be no problem.

Future expansion is for a 64K add-on memory card and a Modem capability. The Adam uses a Z-80 processor and it is planned to run C/PM software.

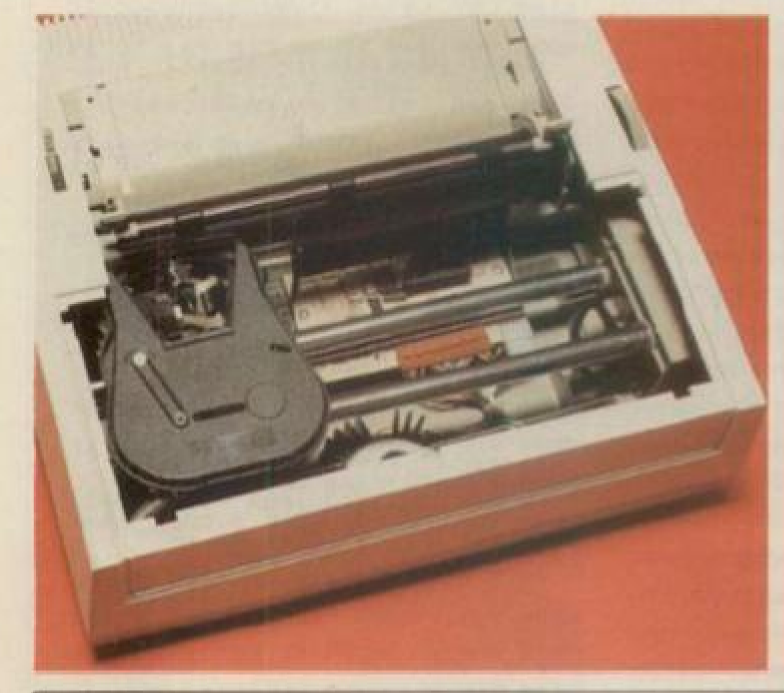
Tape drive comparison

	Coleco Adam	*Sinclair Microdrive*
Save	58	12
Erase/Delete	11	13
Load	5	5
Catalogue	18	10
Capacity	500K	90K

The format of the Sinclair Microdrive commands is significantly more compicated than those of the Adam. The timings are average times taken on a small number of test files, the only signicant difference is in the time taken to save a file and in the capacity of the storage media. ■

CONCLUSIONS

- The philosophy of the Adam may well be correct, the small business user does not need Basic, just a tool which replaces a typewriter and runs business software plugged in or loaded from tape.
- The success, or lack of it, will depend almost entirely on the business software. Given a sufficiently wide range of off-the-shelf packages then the Adam will satisfy a market requirement, but the packages must cater for the idiosyncrasies of the UK market.
- The initial impetus of the Adam has been lost by the late launch date and will probably be overshadowed in the UK by Sinclair's next ZX and later on by the baby IBM and a new Commodore business machine.
- At that point, the pricing policy will be of much greater significance than at present, probably about £700 after the addition of 15 percent VAT and 6 percent import duty.
- I think that it would be unwise to rely on a single cartridge drive, it would be prudent to have a backup. The use of a daisywheel printer does restrict the type of graphical output available which I would have thought is not unimportant in a business machine, but then a premium is normally paid for quality print.
- The rock steady display and on screen function key labelling is very good. I am a bit concerned about writing to tape which contains my only copy of Basic but then the average user is unlikely to Poke around and cause problems.
- The Adam represents extremely good value in the small business market which is word processor orientated.

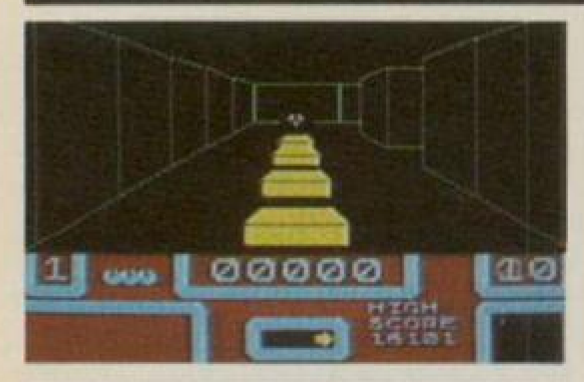


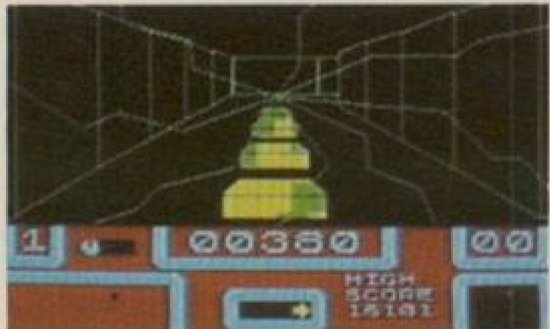


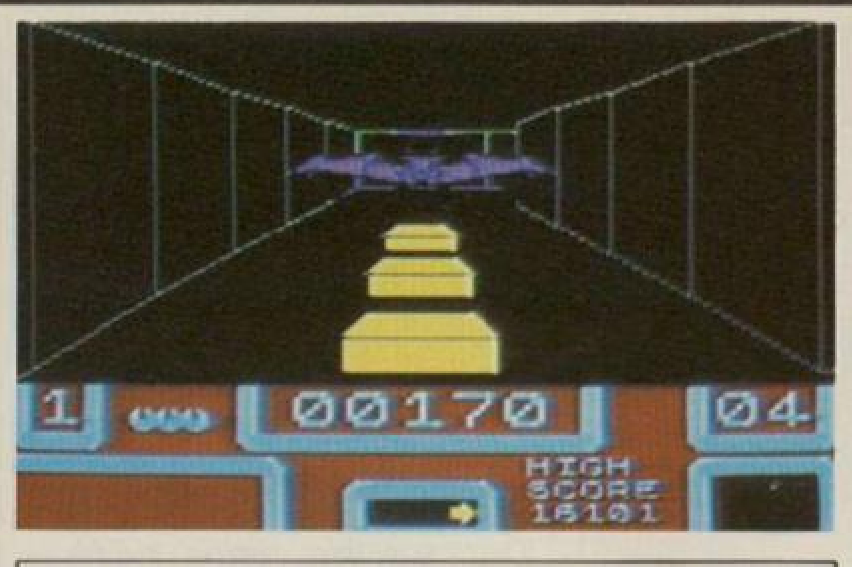
```
Hi Cathy
FATAL SYSTEM ERROR
```

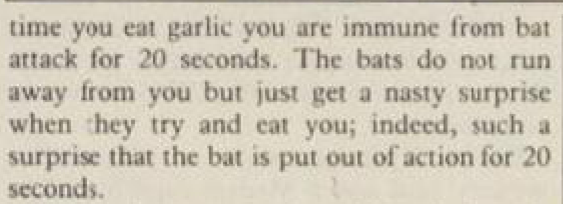
Maybe Coleco's Smart Basic isn't so smart. Opening up the ROM reveals a secret message from one of the Lazer Micro Systems programmers to Cathy — whoever she is.

```
Coleco SmartBASIC V1.0 (c) 1983, Lazer MicroSystems Inc
```









YOU ARE IN THE depths of Transylvania entombed in the tower of Count Dracula's Castle. The floors are laden with gold just waiting to be collected. The only drawback is that each floor of the tower also has a collection of vampire bats.

As you clear each floor of gold vampire bats appear on that floor. Your only means of survival is quick thinking and garlic. Every time you eat garlic you are immune from bat attack for 20 seconds. The bats do not run away from you but just get a nasty surprise when they try and eat you; indeed, such a surprise that the bat is put out of action for 20 seconds.

Your other means of avoiding the bats is using the lift. The lift will transport you between the floors of the tower at your will.

With four bats in the maze at their most vicious you stand little chance. Or are you skilful enough to survive?

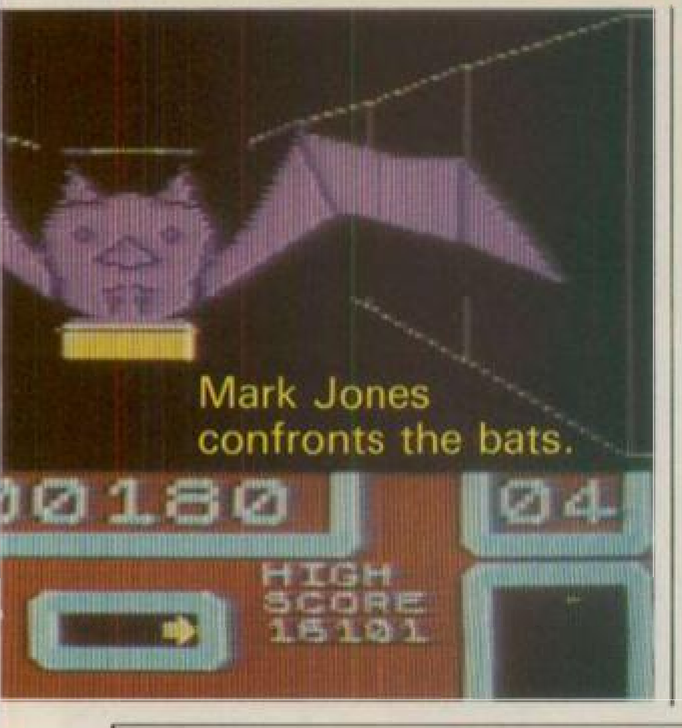
The controls for the game are:

5 = move left.
6 = move right.
7 = move forward.
8 = move backwards.
Capshift 5 = rotate left.

Program 1.

```
   1 DATA "183c7eff3c3c3c3c"
   2 DATA "3c3c3c3cff7e3c18"
   3 DATA "10307fffff7f3010"
   4 DATA "080cfeffffffe0c08"
   5 DATA "002418ffffbd1800"
   6 DATA "0018bcffff182400"
   7 DATA "1c185c3e3e5c181c"
   8 DATA "38183a7c7c3a1838"
   9 DATA "2466e7e7ffff7e3c"
  10 DATA "3c7effffe7e76624"
  11 DATA "3c7eff0f0fff7e3c"
  12 DATA "3c7efff0f0ff7e3c"
  13 DATA "0018245abdbd5a5a"
  14 DATA "00003c3c3c3c0000"
  15 DATA "ff81a1a1a1b981ff"
  16 DATA "7e7e7e7e7e7e7e7e"
  17 DATA "00ffffffffffff00"
  18 DATA "00fefefcfefefe7e"
  19 DATA "000f1f3f7f7f7f7e"
  20 DATA "7efefefefcf8f000"
  21 DATA "7e7f7f7f3f1f0f00"
  22 CLEAR 30999
  23 DIM s$(8,32)
  24 LET s$(1)="P   P       P
     P   P      P"
  25 LET s$(2)="P   P III P
     P   P      P"
  30 LET s$(3)="UOOT         UOOOOOO
OOOOOOT    UOOOOT"
  40 LET s$(4)="OOOOOOOOOOR BLOC
KED HIGH   SOOOOR"
  50 LET s$(5)="YOU ARE INP   SOO
OOR SCORE P      P"
  60 LET S$(6)=" THE LIFT P   PCA
BDP        P     P"
  70 LET s$(7)="WHICH         P   UOO
OOT        P     P"
  80 LET s$(8)="FLOOR? 1-4P
           P     P"
 999 DIM b$(64,16)
1010 LET b$(1)="S00000000000000R
"
1020 LET b$(2)="PONNNNNMPNNNNN P
"
1030 LET b$(3)="PNSOONPNPNOOORNP
"
1040 LET b$(4)="PNPNNNPNPNNNNPNP
"
1050 LET b$(5)="PNPNSOTNNNORNPNP
"
1060 LET b$(6)="PNPNPNNNPNNPNNMP
"
1070 LET b$(7)="PNNNNNOO[illegible]ONUOOOP
"
1080 LET b$(8)="POOOONNNPNNNNNNP
"
1090 LET b$(9)="PNNNNNPNPNOOORNP
"
1100 LET b$(10)="PNSOONP PNNNNPN
P"
1110 LET b$(11)="PNPNNNNNNNNORNNN
P"
1120 LET b$(12)="PNPNPNUORNNPNPN
P"
1130 LET b$(13)="PNNNNNNPUONPNPN
P"
1140 LET b$(14)="PNOONPNPNMNPNPN
P"
1150 LET b$(15)="P NNNNNNNPNNNN
P"
1160 LET b$(16)="UOOOOOOOOOOOOOO
T"
2010 LET b$(17)="SOOOOOOOOOOOOOO
R"
2020 LET b$(18)="PONNNNNNPNNNNNN
P"
2030 LET b$(19)="PNOOORNPNOONOON
P"
2040 LET b$(20)="PNNNNPNNNNNNNNN
P"
2050 LET b$(21)="PNORNUONORNSOON
P"
2060 LET b$(22)="PNNPNNNNNPNPNNN
P"
2070 LET b$(23)="PONNNPMPNNNNNOO
P"
2080 LET b$(24)="PNNPNPNUOONPNNN
P"
2090 LET b$(25)="PNOTNPNNPNNUOON
P"
2100 LET b$(26)="PNNPNNPNPNOONNN
P"
2110 LET b$(27)="PONUONPNN NNNPM
P"
2120 LET b$(28)="PNNNNNNNOOORNPN
P"
2130 LET b$(29)="PNPNSOONNNNPNPN
P"
2140 LET b$(30)="PNPNPNNNOONPNNN
P"
2150 LET b$(31)="P MNNNPNNNNNNP
P"
2160 LET b$(32)="UOOOOOOOOOOOOOO
T"
3010 LET b$(33)="SOOOOOOOOOOOOOO
R"
3020 LET b$(34)="PONNNOOOORNNNN
P"
3030 LET b$(35)="PNORNNNNNPNPNPM
P"
3040 LET b$(36)="PNNPNSOONPNPMPN
P"
3050 LET b$(37)="PONNNPNNNPNNNNN
P"
3060 LET b$(38)="PNNPNPNPNPNOOOO
P"
3070 LET b$(39)="PNSTNPNPNNNNNNN
P"
3080 LET b$(40)="PNPNMNNUONPNORN
P"
3090 LET b$(41)="PNPNSONNNNPNNPN
P"
3100 LET b$(42)="PNPNPNNPPNUONNN
P"
3110 LET b$(43)="PNP PNS[illegible]PNNNNPN
P"
3120 LET b$(44)="PNNNPNPTUOOOOTN
P"
3130 LET b$(45)="PNPNNNPNNNNNNNN
P"
3140 LET b$(46)="PNPNPNPNPNOOOON
P"
3150 LET b$(47)="P NNPNNNPMNNNN
P"
3160 LET b$(48)="UOOOOOOOOOOOOOO
T"
4010 LET b$(49)="SOOOOOOOOOOOOOO
R"
4020 LET b$(50)="PONNNNPNNMNNNN
P"
4030 LET b$(51)="PNOOONPNPNOOOON
P"
4040 LET b$(52)="PNNNNNNNPNNNNNN
P"
4050 LET b$(53)="POOOONPNPNORONO
P"
4060 LET b$(54)="PNNNNNPNPNNPNNN
P"
4070 LET b$(55)="PNSRNOTNPPNPNPN
P"
4080 LET b$(56)="PNUTNNNNPN NNPN
P"
4090 LET b$(57)="PMNNOORNNNORNNN
P"
4100 LET b$(58)="PNPNNNUONORUOOO
P"
4110 LET b$(59)="PNNNPNPNNNPNNNN
P"
4120 LET b$(60)="PNPNNNPNPNPNSON
P"
4130 LET b$(61)="PNPOONNNPNNMPNN
P"
4140 LET b$(62)="PNPNNNPNPNPNPNO
P"
4150 LET b$(63)="P NNPNPNNNNNNN
P"
4160 LET b$(64)="UOOOOOOOOOOOOOO
T"
5000 FOR g=0 TO 3: FOR f=1 TO 16
: PRINT b$(g*16+f): NEXT f: PAUS
E 0: CLS : NEXT g
5001 FOR f=1 TO 8: PRINT s$(f):
NEXT f
5002 PRINT : PRINT "udg graphics
 being created": RESTORE : LET s
s=0: FOR f=1 TO 21
5003 READ a$
5004 FOR s=1 TO 16 STEP 2
5005 LET a=CODE a$(s): LET b=COD
E a$(s+1)
5010 IF a>96 THEN LET a=a-39
5015 IF b>96 THEN LET b=b-39
5020 LET a=a-48: LET b=b-48
5030 POKE USR "a"+ss,a*16+b
5040 LET ss=ss+1
5050 NEXT s: NEXT f
5055 CLS
5060 PRINT "ABCDEFGHIJKLMNOPQRST
U"
5098 PRINT AT 21,0;"Press any ke
y to continue": PAUSE 0: CLS
5099 PRINT "Data being stored"
5100 LET S=31000: FOR F=1 TO 64:
 FOR G=1 TO 16: POKE S,CODE B$(F
,G): LET S=S+1: NEXT G: NEXT F
5200 FOR g=1 TO 8: FOR f=1 TO 32
: POKE s,CODE s$(g,f): LET s=s+1
: NEXT f: NEXT g
5250 FOR f=USR "a" TO USR "a"+21
*8-1
5260 POKE s,PEEK f: LET s=s+1: N
EXT f
5300 PRINT "Data stored"
5310 PRINT AT 21,0;"Press any ke
y to save data": PAUSE 0: CLS
5400 SAVE "mz/cr/udg"CODE 31000,
1448
```

Note: enter the letters between quotation marks in graphics mode except where they form words, eg., "YOU ARE IN" in line 50



Mark Jones confronts the bats.

DRACMAN

Capshift 8 = rotate right.
Capshift 6 = turn around.
0 — View maze — while 0 is being pressed you cannot move. The bats can.

You also have a radar at the bottom of the screen to tell you where the bats are.

Your screen during the game has a 3D view down the passage you are facing, filled with gold, garlic and if you are unlucky a bat flapping towards you.

You have three lives. Each time you are killed there is spectacular machine code sound. The program is the same for 16K and 48K machines and automatically detects what type of machine you have using slightly different techniques for generating the display. Thus, the 48K display is smoother than the 16K display.

Now to the arduous business of typing in the program. There are six Basic programs which generate the code. After you have typed in each Basic program Save it before you Run it.

The first program generates the data for the four mazes, lower screen display and user defined graphics. This program is fairly straightforward. Once you have Run it Save the code using line 5400.

The second program is a little routine that

(continued on page 75)

Program 2.

```
   1 DATA "1845fdcb57c606af0e80c
5cd827138091 0f9c10dca8f7118f1c50
600cd827138030418f8f1b8280df5c5c
de522c104f1b820",6761
   2 DATA "f518ddcde52218d8c5cda
a2247047e0710fd1fc1c92ab05cfdcb4
786eb21004001881 3cdb871af1213210
058012003fdcb47",13623
   3 DATA "c6cdb871af1213eb22b05
cc97ea7200b35230b78a720f5b020f2c
9e57cd640fdcb47462802d61867eb732
3722322b05cebe1",20460
   4 DATA "13c5011000edb00611052
b1b7ea728f9e52ab05c70e123c11318b
f",24024
   5 CLEAR 28999
   8 LET c=0
   9 LET f=29000
  10 FOR h=1 TO 4
  20 READ a$
  30 FOR s=1 TO LEN a$ STEP 2
  40 LET a=CODE a$(s): LET b=COD
E a$(s+1)
  50 LET c=c+b+a
  60 IF a>96 THEN LET a=a-39
  70 IF b>96 THEN LET b=b-39
  80 LET a=a-48
  90 LET b=b-48
 100 POKE f,a*16+b
 110 LET f=f+1
 120 NEXT s
 130 READ tot
 140 IF tot<>c THEN PRINT "Error
 at line ";h: STOP
 150 NEXT h
```

Program 3.

```
   1 CLEAR 28999
   2 RESTORE : DATA 1000,1060,10
70,1080,1040,1060,1070,1080
   3 DIM a(4,2): FOR f=1 TO 2: F
OR g=1 TO 4: READ a(g,f): NEXT g
: NEXT f
   4 DATA 8,48,73,87,101,109,115
,120,123
   5 DIM b(9): FOR h=1 TO 9: REA
D b(h): NEXT h
   6 LET tt=1
  10 LET r=29200
  11 LET ss=26537
  12 LET s=29272
  13 POKE 23729,INT (s/256): POK
E 23728,INT (256*(s/256-PEEK 237
29))
  14 LET rr=r-ss
  20 BORDER 0: PAPER 0: INK 0: C
LS
  80 FOR t=1 TO 4
  90 FOR k=1 TO 9
  91 CLS
  92 LET at=0
  95 RESTORE a(t,tt)
  96 LET tt=tt+1: IF tt=3 THEN L
ET tt=1
  97 LET v=119/(127-b(k))
 100 READ x
 105 IF x=253 THEN GO SUB 8000:
GO TO 200
 109 READ y
 110 IF x=255 THEN GO TO 150
 111 IF k>5 THEN GO SUB 8100
 120 DRAW INK at;x/v,y/v: GO TO
100
 150 READ a: PLOT INK at;127-y/v
,128-a/v: GO TO 100
 200 NEXT k: NEXT t: INK 7: GO T
O 7000
```

(Program 3 continued on page 75)

Step into the third dimension

GSH

Take a giant step closer to reality with New Generation Software. The 3D Graphics of New Generation programs bring the screen alive and makes other games look as flat as snakes and ladders.

Spectrum owners will find that seeing is believing when they open the door on 'THE CORRIDORS OF GENON', the latest creation from New Generation. You will be saving the Universe from the evil that now controls all things. But beware – the sound of footsteps approaching could be Bogul!

Hurtle into a void leaving a trail for your unseen pursuers in 'KNOT IN 3D'. Weave your way through up to five trails but be careful, you could get knotted! Or travel through the depths of a moving tunnel full of bats, rats, spiders and toads in '3D TUNNEL', with a special surprise in the 48K version.

Stamina is the vital ingredient of 'ESCAPE', as you'll be venturing into the maze pursued by walking and flying dinosaurs.

ZX81 owners must be prepared for the shock of coming face to face with the T. Rex that leaps out from '3D MONSTER MAZE'. '3D DEFENDER' takes you out of this world and plunges you into space in a fast moving game to defend your home planet against alien spacecraft in a blitz of explosions, plasma blasts and photon beams.

All these exciting 3D games have been designed by Malcolm Evans, the 3D expert. They'll have you leaping out of your seat because you don't just play New Generation games, you live them.

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Available from **W H Smith, Boots, Menzies, Spectrum Group** and all leading computer stores.

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(program 3 continued from page 73)

```
 999 REM bat wing up
1000 DATA 255,105,30,25,35,16,0,
24,7,12,-26,13,-15,255,105,30,24
,11,31,9,32,-24,255,80,18,0,22,2
55,49,9,9,21
1010 DATA 255,0,5,-16,-3,3,11,7,
-10,255,16,8,-4,-8,2,-8,3,-11,7,
-4,255,8,39,8,0,255,0,17,-7,-6,7
,-2,255,7,32,6,2,255,7,32,7,0,25
5,4,32,1,-5,1,5,255,12,16,2,-2,2
,2,-2,2,-2,-2
1020 DATA 253
1030 REM wing down
1040 DATA 255,119,27,24,20,20,-3
,35,5,1,-7,8,-4,12,-4,3,-11,6,-7
,-42,8,-40,5,-26,-3,255,99,26,7,
13,255,50,30,7,20
1050 DATA 255,0,5,-16,-3,3,11,7,
-10,255,16,8,-4,-8,2,-8,3,-11,7,
-4,255,8,39,8,0,255,0,17,-7,-6,7
,-2,255,7,32,6,2,255,7,32,7,0,25
5,4,32,1,-5,1,5,255,12,16,2,-2,2
,2,-2,2,-2,-2,253
1059 REM gold
1060 DATA 255,0,76,-24,0,0,12,24
,0,255,24,64,8,8,16,0,253
1069 REM garlic
1070 DATA 255,0,69,-5,10,5,18,-9
,-16,9,-12,-14,8,0,7,14,13,-15,-
8,-3,-5,3,-5,15,-10,253
1079 REM  lift
1080 DATA 255,127-64,128-96,56,0
,0,32,-56,0,0,-32,255,127-70,9,0
,-16,9,0,0,-1,-10,0,0,17,255,127
-84,9,0,-17,0,1,0,17,255,127-90,
9,0,-17,0,1,0,17,255,127-90,8,10
,0,0,-1,-10,0,255,127-90,17,8,0,
0,-1,-8,0
1090 DATA 255,127-105,8,11,0,0,-
1,-11,0,5,0,0,-16,1,0,0,16,253
6000 LET yy=h-rr
6030 POKE f+1,INT (yy/256): POKE
 f,INT (256*(yy/256-PEEK (f+1)))
6040 RETURN
7000 FOR f=29200 TO 29271 STEP 2
7001 PRINT #0;"Press any key to
continue": PAUSE 0
7002 CLS
7003 LET vv=16384
7010 LET h=PEEK f+256*PEEK (f+1)
7015 GO SUB 6000
7020 LET l=PEEK h+256*PEEK (h+1)
7025 IF PEEK h=0 AND vv=16384 TH
EN LET vv=22528: LET h=h+1: GO T
O 7020
7030 IF PEEK h=0 THEN NEXT f: GO
 TO 9999
7040 LET b=PEEK (h+2): LET h=h+3
7050 FOR e=1 TO b
7060 POKE l+vv,PEEK h
7070 LET l=l+1: LET h=h+1
7080 NEXT e: GO TO 7020
8000 POKE r+1,PEEK 23729: POKE r
,PEEK 23728
8001 GO SUB 8100
8004 POKE 23695,at
8005 LET r=r+2
8010 IF k>5 THEN RANDOMIZE USR 2
9000: RETURN
8020 RANDOMIZE USR 29002
8030 RETURN
8100 IF t=1 THEN LET at=3
8110 IF t=2 THEN LET at=6
8120 IF t=3 THEN LET at=7
8130 IF t=4 AND k<5 THEN LET at=
58
8140 IF t=4 AND k>=5 THEN LET at
=2
8150 RETURN
9999 SAVE "data"CODE 29200,3460
```

(continued from page 73)

generates machine code for use in the third program. Type this in and Save it. Now try to Run it. Once you have corrected all mistakes and Run successfully you will have a machine-code routine stored at 29000. Every time you Run program 3 you will need this machine code at 29000.

Type in this program and Save it. This routine produces half images of graphics used in the main program. When Run the program will first blank the screen and then generate the bats, gold, garlic and lifts in half images in nine different sizes.

It is important that you go through all the graphics before you Save them. Now Save the code using line 9999.

The next stage is to type Rand USR 0 and then load up with the code from programs 1

(continued on next page)

Program 4

```
   5 CLEAR 29999
  10 DATA "3e0332415b21120022e15
b210067227b5c21000022355b06040e0
13e20111d5b21255b7112231310fa3ec
832de5b3ab55cd63f32d45bc61832d55
b3ec332225dcdad7b21d85b112d5b010
400edb021597b22235d3e19ed47ed5e3
e15328d5ccd237bcd32"
  11 DATA 13091
  20 DATA "7ccd617c3e04328d5c328
f5c3e1e320d5b320f5b32115b32135b1
600cd977b3e01320a5b3dcde47b0e00c
d2a79cd757acdfa79cd487ccd7f7c2a3
d5b46c5cd467dc110f901fe7fed781f3
8e43e3eed56ed47af2a0b5bed5b355be
d52d0ed530b5bc9cdaa"
  21 DATA 14620
  30 DATA "224c473ad45b84d64067c
9d5e5ed437d5ccdf675043e010f10fd4
6b07779cd1c76e1d1c90f0f0fe603473
ad55b80673a8f5c77c9d5e5d9e5d92a7
d5c78943804160118031 6ff2f4779953
8041e0118031eff2f4fb8300669d5af5
f1807b1c86841d51600"
  31 DATA 13412
  40 DATA "60781f853803bc3807944
fd9c1c518044fd5d9c12a7d5c7884477
93c853d4fcd0376d97910ddd1d9e1d9e
1d1c90afeffc8e503c5f5cbbf16005f1
94ef11730043eff914f59c10a03e1e5c
54b5f1946d1e1afc96826002929 11a45
b19065ccd8976cd0376"
  41 DATA 13706
  50 DATA "424bcd897617d8cd2c761
8f4c5fdcb47863ad45bcde3763ad55bf
dcb47c6cde376c1c91e00574e234679a
7c823d5eb09eb4623c57e12231310fac
17be61f4f3e20914f3ee0a3b15fe52b7
efdcb4746c5200806081fcb1110fb79c
1121310eae1d118c3fd"
  51 DATA 14109
  60 DATA "cb47be0601ed5bdf5b2ae
15b197ed5e5fe20286ffe9f382ffdcb4
77e20070ef4c5cdaf76c1e1d1fdcb477
```

(program 4 continued on next page)

(program 4 continued from previous page)

```
ec0e5c5d5cdc177d1c105280efdcb47f
e210000afed52ebe118c7e1c9fe9e281
cfdcb477e2832fe9c200521cd671819f
e9d200521bb671810fe"
  61 DATA 14703
  70 DATA "9e200521df67180721a96
7fdcb47def5783d8716005f195e2356e
bcdcc76f1fe9e289e3e09b82899fdcb4
77e2805052890180104e1d1c33077ed5
bdf5b7b1f2ae15be5f53006d51111001
9d12bafbac52813cd0078c1f1e13006d
511efff19d123cd0c78"
  71 DATA 13741
  80 DATA "c9cd0c78c1f1e13006d51
1efff19d123cd0078c93ed032d05b3ed
932d25b180a3ee232d05b3eeb32d25b0
e00c5417efe9f30053ad25b18033ad05
b4fe5d5cdaf76d1e119c1050c78fe002
0e0c9f0ff1000fff01001000f0ff010
0ffffffff01001000f0"
  81 DATA 14094
  90 DATA "ff0100ffff0ff10003e0
2cd01162ad65b06103e16d7afd7afd71
620c5cd817806107e23cd8d78d710f8c
d8178c110ecc906083e04328f5c7ad71
0fcc94fd6903828fe0f38043e04181de
60ccb3f1f1f380b1f38043e06180e3e0
2180a1f3e0338021803"
  91 DATA 13592
 100 DATA "a9d698328f5c79c92ae15
b197efe9fd2027bfdcb47decdb47a22e
15bfe9d20070e0acd2a79181afe9c201
10e32cd2a793e0132005b3e1532015b1
805fe9ecae3793e98cd107977afed52f
dcb475628043e9e18023e2077fdcb479
6c9d5cb12380bcb1b38"
 101 DATA 14140
 110 DATA "033cd1c9c603d1c9cb1b3
802d1c9c602d1c9e53ec8b92803cd857
f2a355b06000922355bcd4179e1c9e5d
5ed5bdc5b01f0d8cdf079cd72790118f
ccdf079cd7279019cffcdf079cd72790
1f6ffcdf079cd727945cd7279d1e1c9e
5d5ebc5cb24cb14cb14"
 111 DATA 14351
 120 DATA "3eaf94477d8717174fcda
a22c1e51108000421783d1910fdd1060
8c5d511000006084a7e17380acb13cb1
2cb13cb121809cb13cb1237cb13cb121
0e823444de1722373d511ff0019d1722
37311ff0019eb6069c13e05b82007e52
120f819ebe110b9d1e1"
 121 DATA 13037
 130 DATA "1313c93e20ed5277fdcb4
7d6cdcd7bc9af093c38fc3ded4247c9c
d0c7b3e98ed5bdf5bcd10792ae15b772
13978ed5bdf5bafcd10798787874f060
009e511000001feefed781f3809e1cd5
978fdcb47dec91f1f380414210600 1f3
8041c2100001f38041c"
 131 DATA 13986
 140 DATA "21020001fef7ed78e6102
0041421040001fefeed78c1094e23466
960cb1a3804cb1b3011eb1f3005cdbc7
8180bed53df5bfdcb47decdb47acd237
7cd8e7afdcb7b7efdcb47e6c4bd7ac92
1ae5aaf0604772310fcaf2adf5bebcd1
079fe032807cb4f2802"
 141 DATA 14487
 150 DATA "3eff3c21ae5a856f3e067
7c9fdcb475ec8fdcb479ed9e5080:001
01100403ad45bcde07a0100021100583
ad55bcde07afdcb47a608e1d9c9fdcb7
b7e2009af12130b78b120f8c9fdcb476
62007571e00cde67ac9672e00edb0c93
e0e1101002110271808"
 151 DATA 13854
 160 DATA "3e1211000021c800f5cdb
503216c5a0608f1772310fcc93e02cd0
1163e16d73e10d7afd711006601c000c
d3c20d53e01cd0116d1210001228a5c2
1c05022865c0140002a8d5c228f5ccd3
c20c9fff3e5d5c5f5060121005bcd827
bdc977b060023cd827b"
 161 DATA 13137
 170 DATA "23cd827b23cd827b23cd8
27bf1c1d1e1fbc95e2356afbad01d200
615ccfd7e1e32722b732337c9e5d56a2
600111b10c362793a0a5b47110110cd7
279c911005e2100620:0004edb0c9218
05a0604111600c5060a772310fc19c11
0f5c93e18cdb97baf32"
 171 DATA 13225
 180 DATA "085ccdbf023a085cd6313
8f2fe0430eef50604cdf47c10fb21011
522005bf1f53c320a5bcda27b3ade5ba
7d60a380332de5bf1212d5b5f1600192
23f5b21255b19223d5bc65e32d75b32e
25b32125b32145b320e5b32105b3e12c
db97bc9219b5a3e0406"
 181 DATA 13561
 190 DATA "04111c00c50604772310f
c19c110f5c90604219b50afc5e511fc0
00608cd3c7ce111200019c110eec93e0
2cd01163e16d73e15d73e14d72a0b5b0
1f0d81e30cd2a19d5e5c3301a3ae15bf
dcb47f6cdac7cfdcb47b62a3d5b46210
d5b11035bc51aa72008"
 191 DATA 13681
 200 DATA "7ee5d5cdac7cd1e123231
313c110ecc921d05b77afed6f17473e1
e90477ecb3fcb1fcb1fc6d84ffdcb477
6200ecdaa2211400019474ce5d5c30c7
605cdee7c040dcdee7c0ccdee7c0ccde
e7c0d04cdee7cc9c5cdc97cc1c921085
dc53a0a5b3d8787803d"
 201 DATA 14861
5000 LET c=0: LET f=30000
5010 FOR h=1 TO 20: READ a$
5020 FOR s=1 TO LEN a$ STEP 2
5030 LET a=CODE a$(s): LET b=COD
E a$(s+1)
5040 LET c=c+b+a
5050 IF a>96 THEN LET a=a-39
5060 IF b>96 THEN LET b=b-39
5070 LET a=a-48
5080 LET b=b-48
5090 POKE f,a*16+b
5100 LET f=f+1
5110 NEXT s
5111 PRINT h
5120 READ tot: IF tot<>c THEN PR
INT "Error at line ";h*10: STOP
5125 LET c=0
5130 NEXT h
```

(continued from previous page)

and 3. To do this

Clear 25087
Code 1 - LOAD" "CODE25088
Code 2 - LOAD" "CODE 26537

It is important to include these numbers.

Finally, Save Code 25088, 4911.

Type in program 4 which produces about 4/5 of the main machine code program. Save the Basic. Run the program and type

NEW

This deletes the Basic but preserves the code now stored at 30000.

Type in program 5. Save it and then Run it. Finally

Save Code 3000, 2568

Now type Rand USR 0. This does a complete New. Now type in the Rem statement. If it is not the right length the Basic program will tell you.

If the task of typing in this program is too much for you, copies are available by sending £2.30 and a self stamped addressed envelope or a jiffy bag to: Mark C Jones, 17 Park Walk, London SW10 0AJ. ■

Program 5.

```
  10 DATA "5f1600197e4f783d875fd
5210d5b195e2356ed53d(5bd12b71211
55b193eff77237721025b193e01773e1
52377cb3b211d5b19ed5bd05b7efe983
804fe9c3801123e2077c1c905dd21ec5
b788721035b5f1600197ea7c0210d5b1
9d522025d5e23561aeb"
  11 DATA 13194
  20 DATA "d1fe983805fe9cda287fe
521158b1922045d211d5b7bcb3f056f2
2065d7ee1fe943804fe983801770e001
10100cdd77d111000cdd77d11ffffcdd
77d11f0ffcdd77d79fe02444d3f300c2
a045d5e23566069197efe9fd4f47deb2
a025d7323722a065d77"
  21 DATA 13804
  30 DATA "3e94d52a045d5e2356cd1
079e177c9e5afdd7700197efe9f380ad
d3500dd3500dd35000ce1dd23dd23dd2
3c9c5dd21ea5b2a375b5e235623cb6c2
80321000022375b3ade5bbbd53044693
ae15bcda37e505f7dcda37e93cdb67e4
f7892cdb67e814f0604"
  31 DATA 14045
  40 DATA "c5dd7e00dd23dd2385cda
37e93cdb67e4f7892cdb67e81c191380
428051806dd3400dd3400dd2310d7f1e
60347808006004fdd21ec5bdd090e020
604dd7e00b92814dd23dd23dd23fe802
005dd21ec5b0410e90d18e4dd2bdd560
0dd2bdd5e00e1e5197e"
  41 DATA 13060
  50 DATA "fe9f3806dd23dd2318d42
a045d732372e119c9060087cb1087cb1
087cb1087cb101f1f1f1fc9d0c547af9
0c1c9cdc57f01f401cd667f3a415b3d3
2415b2854f53e10328f5c3e16d73e11d
7f1c605d73e20d73e04328f5c2a3d5b4
6cdf47c10fb06052140"
  51 DATA 13601
  60 DATA "9c2b7cb520fb10f6c9afa
0c0d5e511015bafed52cb3deb2a3d5b7
ebb380ce1e5110a00194e23463e94020
600e1d1c9c1c1c3e0753a015ba7cabd7
e04c5016400cd667fcb3b211d5b197ef
e9d20070e0acd2a791813fe9e200f0e3
2cd2a793e0132005b3e"
  61 DATA 14093
  70 DATA "1532015b0ec8cd2a79c1c
df47cc93a485ce6380f0f0ff6081608c
57aee1057d3fe78b10b20fbc10b78b12
0eec9c52a3f5b7e3d772035110c00e51
97ed1122a3d5b7efe0428043c77180c3
ade5b2007d60a300332de5b2ad65b545
d01000409010001edb0"
  71 DATA 13651
  80 DATA "0604cdf47c10fbc1c92ad
45be5214058 22d45b214a5b110a00060
4c5e50608c5e54e234623cd03764e234
6cd2c76e119c110ece12323c110e2e12
2d45bfdcb47dec9"
  81 DATA 8933
5000 LET c=0: LET f=32000
5010 FOR h=1 TO 8: READ a$
5020 FOR s=1 TO LEN a$ STEP 2
5030 LET a=CODE a$(s): LET b=COD
E a$(s+1)
5040 LET c=c+b+a
5050 IF a>96 THEN LET a=a-39
5060 IF b>96 THEN LET b=b-39
5070 LET a=a-48
5080 LET b=b-48
5090 POKE f,a*16+b
5100 LET f=f+1
5110 NEXT s
5111 PRINT h
5120 READ tot: IF tot<>c THEN PR
INT "Error at line ";h*10: STOP
5125 LET c=0
5130 NEXT h
5131 IF f<>32766 THEN PRINT "wro
ng number of data bytes": STOP
5200 SAVE "draccode"CODE 30000,2
768
```

Program 6.

```
   1 REM ffffffffffffffffffffffff
ffffffffffffffffffffffffffffffff
ffffffffffffffffffffffffffffff
   3 IF PEEK 23757>87 THEN PRINT
 "rem statement too long": STOP
   4 IF PEEK 23757<87 THEN PRINT
 "rem statement too short": STOP

   5 GO TO 100
  10 DATA 0,48,175,255,7,52,172,
255,47,78,158,255,71,93,148,255,
87,103,143,255,99,110,138,255,10
8,116,135,255,114,120,133,255,11
9,123,131,255,122,125,130,255,12
4,127,128.6134
  11 DATA 0,1,4,5,4,6,0,2,255,0,
5,4,5,4,6,0,6,255,128,1,132,5,13
2,6,128,2,255,128,5,132,5,132,6,
128,6,255,0,1,128,1,128,2,0,2,0,
1,255,2666
  12 DATA 128,115,139,130,138,15
5,147,164,147,175,128,115,172,13
6,210,136,220,144,255,152,128,11
5,206,106,226,83,240,83,255,64,1
28,115,169,94,170,78,194,66,200,
48,128,115,152,80,140,64,144,57,
128,48,128,115,108,78,74,67,64,5
6,44,48,128,115,86,97,56,106,40,
98,0,123,128,115,90,129,88,144,5
8,153,56,175,9697
  13 DATA 30,151,225,238,30,169,
225,238,30,162,225,238,30,122,22
5,238,2576
  14 DATA 1,0,0,16,0,0,255,255,0
,240,255,0,128,128,128,1406
  15 READ a
  20 IF a>255 THEN GO TO 30
  25 POKE f,a: LET d=d+a: LET f=
f+1
  26 GO TO 15
  30 IF d<>a THEN PRINT "Error i
n data": STOP
  40 PRINT "data ok": RETURN
  50 LET f=23760: LET d=0: RESTO
RE 11: GO TO 15
  60 LET d=0: LET f=23370: RESTO
RE 12: GO TO 15
  70 LET d=0: LET f=23816: RESTO
RE 13: GO TO 15
  80 LET d=0: LET f=23530: RESTO
RE 14: GO TO 15
  90 LET f=23460: LET d=0: RESTO
RE : GO TO 15
 100 GO SUB 90
 110 GO SUB 80
 120 GO SUB 70
 130 GO SUB 60
 140 GO SUB 50
 145 POKE 23516,11: POKE 23517,1
6
 150 POKE 23519,1: POKE 23520,0
 155 POKE 23512,117: POKE 23513,
119: POKE 23514,112: POKE 23515,
116
 160 PRINT "all ok"
 175 REM
 180 REM Now delete lines 3-170
 185 REM
 190 REM  Now add this line
 195 REM
 200 REM 10 BORDER 2: CLEAR 2406
3: LOAD ""CODE : LOAD ""CODE
 205 REM
 210 REM Now SAVE "Dracman" LINE
1
 220 REM
 230 REM Now SAVE "prbuf"CODE 23
296,255
```



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SPLAT ☐ MOUNTAINS OF KET ☐ 1984 ☐

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My name is Diamond, Dan Diamond,

and this is my story. A story of beautiful mermaids, bored robots and dank, dark dungeons. A story that started one muggy day in New York, and like the Big Apple, it's rotten to the core.

The Dan Diamond Trilogy is three separate adventure games. Each game may be played on its own, but clues may be found in the earlier adventures which may help later on. Each game comes with a lavishly illustrated 20-page case file, and hints (both helpful and misleading) which have been hidden in the illustrations.

Part I. Franklin's Tomb, in which our hero receives a mysterious plea for help which leads him to a hidden tomb and the mystery of the stargate.

Part II. Lost in Space, in which our hero finds himself stranded on a derelict spacecraft, doomed to travel endlessly through space, or find a way out.

Part III. Fishy Business, in which our hero lands on a watery planet, discovers the source of the plea for help and saves the day.

"It must be the most consistently enjoyable adventure game I've ever played"
– Computer Choice (Program of the Month) –

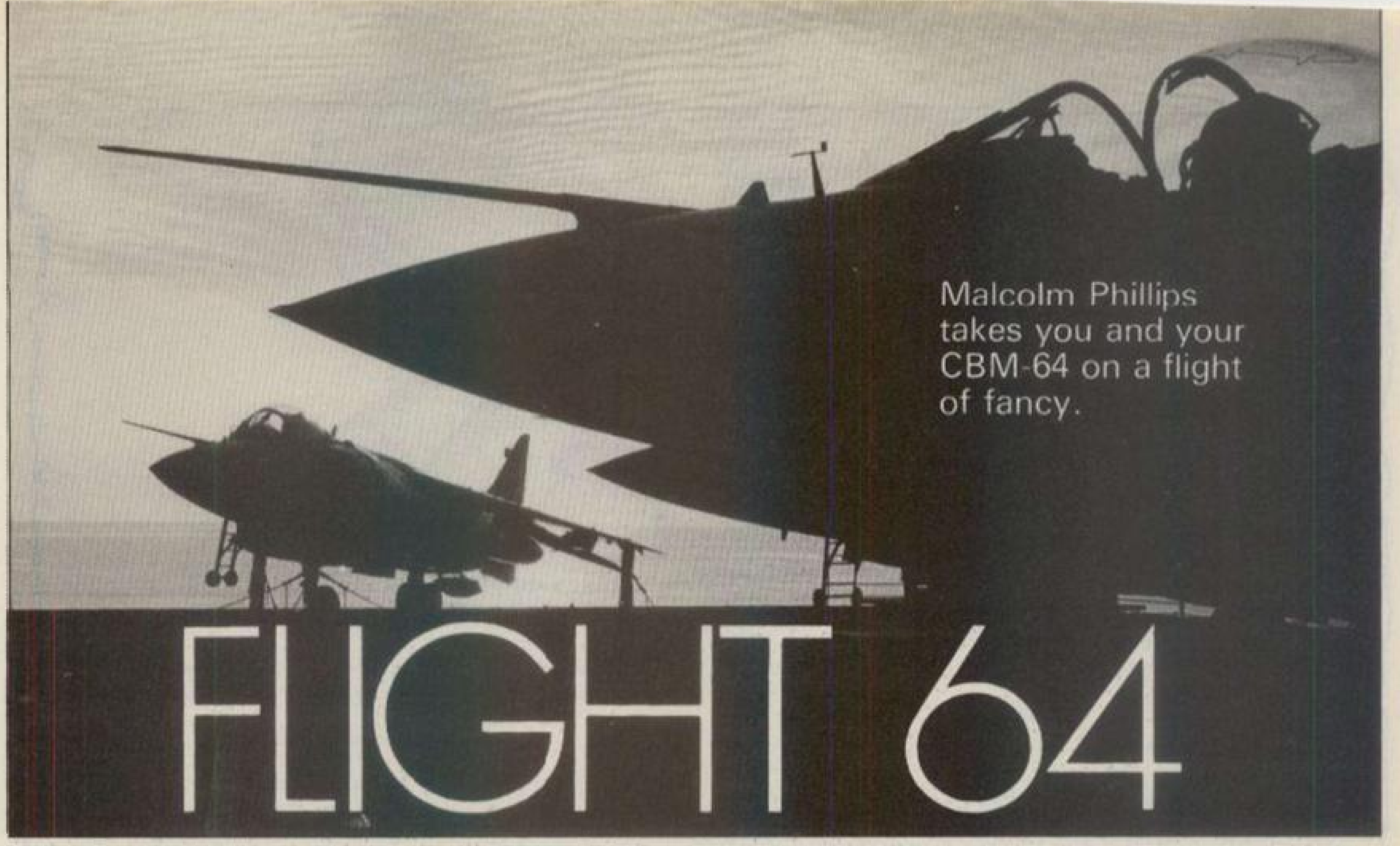
All three programs cost £9.95 each and are available for the DRAGON 32, BBC MODEL B and 48k ORIC-1 microcomputers. (note: Fishy Business for the BBC and ORIC will be available February 1984).

Cheques or postal orders payable to:

Salamander SOFTWARE

17 Norfolk Road, Brighton, East Sussex, BN1 3AA.

Look out for Dan Diamond's next Adventure Series "Franklin in Wonderland" Available Spring 1984



Malcolm Phillips takes you and your CBM-64 on a flight of fancy.

FLIGHT 64

IMAGINE THAT you are in a harrier and you are about to start your landing on an island. Your vertical take off and landing system is disabled so you must land the aircraft in the conventional way.

Your Commodore 64 shows the instrument panel and the view through the flight deck windscreen. To land the aircraft you must use your keyboard to control the flight.

You must line the black cross at the centre of the flightdeck with the centre of the runway. To do this you may have to make a turn to the left or to the right. If the heading shown on your compass is say -789 metres then you will crashland 789 metres from the runway. To correct this press the key A. You will see the compass reading reduce towards zero. A white crosswire will move towards the centre of the windscreen. This is the coarse crosswire. A black crosswire is the fine course setting. When your course is correct the compass will show zero and the two crosswires line up with the black cross on the flightdeck.

While you are doing this there are a number of other controls to keep in mind. You should reduce the engine thrust as soon as possible to preserve your fuel for the landing. You do this with key S — Slow. If you slow down too much the aircraft will stall. A red stall alarm will announce this condition. You can speed up again with key F — fast.

You can also speed up by diving. Key X causes the plane to dive, this causes the airspeed to increase and the horizon shown in your windscreen to become higher as you dive towards the sea. When you dive or climb the rate at which you move vertically is shown on the VSI — Vertical Speed Indicator. This indicator is particularly useful near touchdown. The distance to the control tower is shown in the top left corner.

When you get to within 20,000 metres you will see the fields and trees as you approach the airport. When you get within 10,000 metres you will see the runway. When you get to within 5,000 metres you will see the control tower. After 2,000 metres concentrate on getting your aircraft down on the runway.

If you do not get on the runway you will overfly the airport and crash. You must not forget to lower your undercarriage before touchdown. You can only lower your undercarriage if your altitude is less than 1,000 feet.

You should aim to land with your airspeed at about 250 kph. When you are within limits your flightdeck displayed values are green. If you get below 1,000ft. and you are more than 100 metres off course then watch out for mountains.

The following notes will enable you to draw at machine code speed a border around the screen, lines of machine code characters or blocks of machine code characters to fill in large areas at least 10 times faster than with Basic. Poke the following characters and use the appropriate Sys command given in the listing to activate the routine.

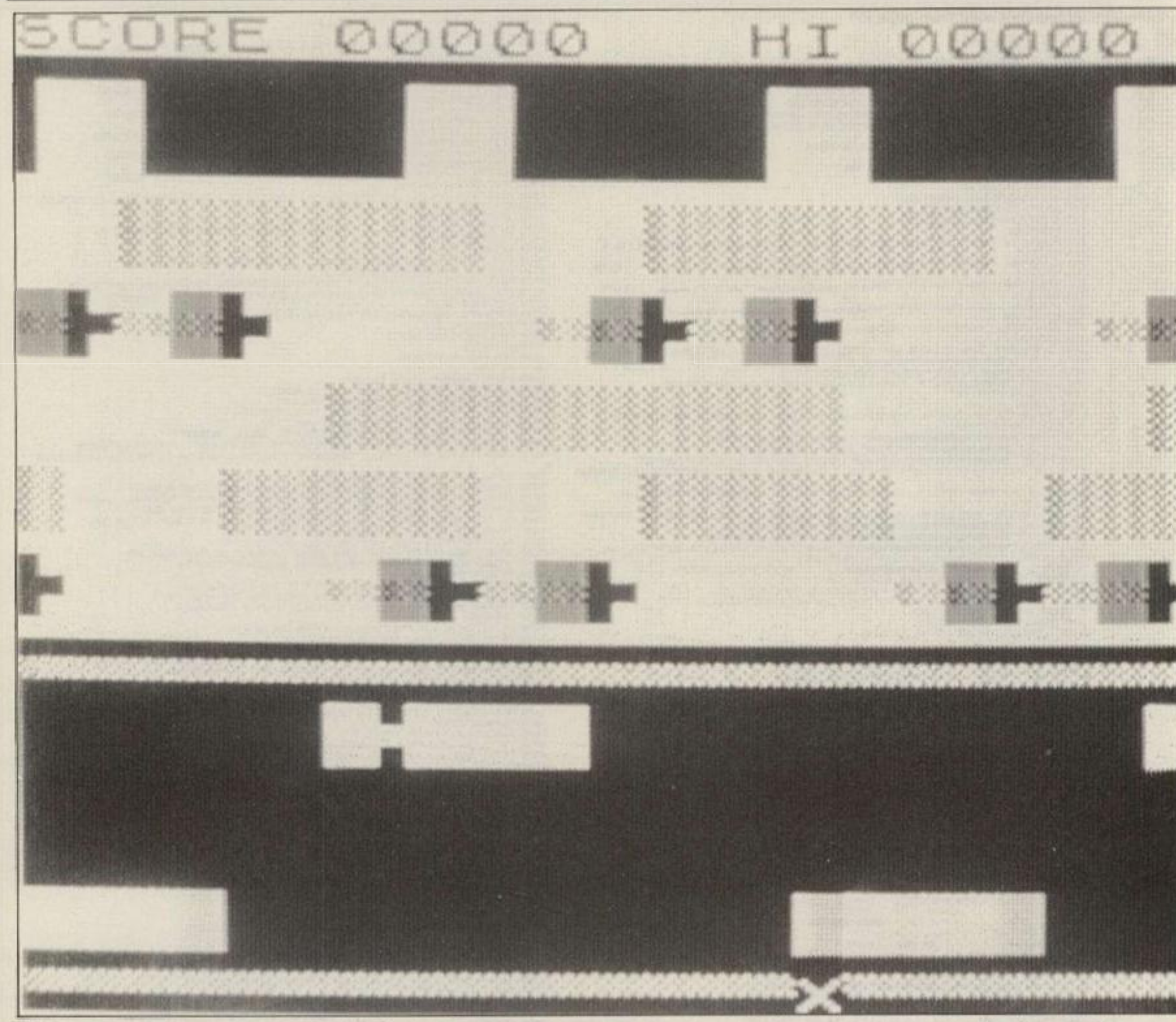
Background colour: Poke 820,Colour1
Foreground colour: Poke 821,Colour2
Border colour: Poke 2,Colour3
Border character: Poke 827,Character
SYS 38000 to draw the border, or wherever you send the data.
Line/Block routines
Character: Poke 719,Character
Length of line N: Poke 731,N Characters
X displacement: Poke 733,X From home position
Y displacement: Poke 734,Y From home position
Character colour: Poke 735,Colour1
Block Depth D: Poke 736,D Lines in block
SYS 38400 Draw line
SYS 38600 Draw block

```
0 REM FOR "■" READ CTRL + KEY 3
300 POKE719,95:POKE720,127:POKE721,102:REM     TOP.CHR     BOT.CHR    LEFT.CHR
310 POKE722,105:POKE723, 40:POKE724,  0:REM  RIGHT.CHR     TOP LINE ADDRESS
320 POKE731,12:POKE53280,13:POKE53281,1:REM     LENGHT   BACKGROUND  FORGROUND
322 POKE732,10:POKE733, 0:POKE734, 1:REM     HEIGHT      X DISP     Y DISP
324 POKE2,2:POKE827,94:POKE820,5:POKE821,1:REM BORDER COLOUR/CHR/FGND/BGND
330 FORI=0TO31:READA:POKEI+680,A:NEXTI
335 PRINT"■■■■■■  FLIGHT BA172 ":PRINT" NAPOLI CONTROL CALLING"
340 FORI=0TO175:READA:POKEI+38000,A:NEXTI
350 FORI=0TO127:READA:POKEI+38200,A:NEXTI
360 FORI=0TO127:READA:POKEI+38400,A:NEXTI
365 FORI=0TO175:READA:POKEI+38600,A:NEXTI:SYS38000
370 FOR I=2TO13:POKE733,20-I:POKE734,I:POKE820,6:POKE821,3:POKE731,I+I:SYS38400
375 NEXT:SYS38400:POKE719,127:POKE733,1:POKE731,38:SYS38400:POKE719,104
380 FOR I=14TO23:POKE733,24-I:POKE734,I:POKE820,8:POKE821,3:POKE731,I+I-6
390 SYS38400:NEXT:GOSUB9001:GOTO3000
400 DATA173,52,3,24,109,54,3,141,251,0,141,12,3,173,53, 3
401 DATA109,55,3,141,252,0,141,55,3,96,255,175,240,0,255, 255
410 DATA162,0,173,52,3,141,32,208,173,53,3,141,33,208,173, 59
411 DATA3,157,192,7,157,0,4,173,2,0,157,192,219,157,0, 216
412 DATA232,224,40,208,233,162,0,169,0,141,53,3,169,24,141, 58
413 DATA3,169,40,141,52,3,169,255,141,54,3,141,56,3,141, 251
414 DATA0,141,253,0,169,3,141,55,3,141,252,0,169,215,141, 57
415 DATA3,141,254,0,160,1,173,59,3,145,251,173,2,0,145, 253
416 DATA173,52,3,24,109,54,3,141,251,0,141,54,3,173,53, 3
417 DATA109,55,3,141,252,0,141,55,3,173,52,3,24,109,56, 3
418 DATA141,253,0,141,56,3,173,53,3,109,57,3,141,254,0, 141
419 DATA57,3,160,0,173,59,3,145,251,173,2,0,145,253,160, 1
420 DATA173,59,3,145,251,173,2,0,145,253,206,58,3,208,177, 96
430 DATA169,0,141,59,3,174,59,3,189,1,208,74,157,199,2, 254
431 DATA199,2,189,199,2,234,201,115,48,5,169,15,133,2,96, 42
432 DATA157,1,208,32,222,255,74,74,74,174,59,3,157,198,2, 189
433 DATA0,208,74,125,198,2,157,198,2,201,124,48,11,12,2, 0
434 DATA141,214,2,141,16,208,169,0,157,198,2,42,157,0,208, 230
435 DATA59,3,230,59,3,165,2,10,133,2,173,31,208,208,12, 173
436 DATA59,3,201,16,48,159,169,0,133,2,96,173,59,3,74, 133
437 DATA2,96,255,15,240,0,255,223,240,176,255,15,240,0,255, 15
440 DATA169,24,205,222,2,16,1,96,162,255,169,4,141,252,0, 169
441 DATA0,141,251,0,169,0,141,253,0,169,216,141,254,0,169, 40
442 DATA24,109,251,0,141,251,0,169,0,109,252,0,141,252,0, 232
443 DATA236,222,2,208,233,162,255,169,40,24,109,253,0,141,253, 0
444 DATA169,0,109,254,0,141,254,0,232,236,222,2,208,233,162, 0
445 DATA173,52,3,141,32,208,173,53,3,141,33,208,172,221,2, 173
446 DATA207,2,145,251,173,2,0,145,253,232,208,236,219,2,208, 239
447 DATA96,240,0,255,15,240,0,255,15,240,0,255,15,240,0, 255
500 DS=H1:Z$="OFF":POKE827,127:SYS38000:N=PEEK(K)
503 IFH1<1000ANDH=12ANDDW%=0THENGOSUB8000
505 IFH1<1000ANDH=12THENU$="■DOWN2":Z=Z+5:V=V-3
507 IFB<>0THENV=V+B*10:B=0
508 IFV>500THENPRINT"■ AIR SPEED TO HIGH -OVERHEAT":V=V-70:GOTO560
509 IFV<10THENV=V+30:GOTO560
510 ON-(H=21)-2*(H=13)-3*(H=20)-4*(H=9)-5*(H=23)GOTO513,515,517,520,530
511 ON-(H=18)-2*(H=10)GOTO540,550
512 GOTO560
513 IFF1>=0THENT1=T1+1:V=V+30:B=1:GOTO560
515 IFF1>=0THENT1=T1-1:V=V-30:B=-1:GOTO560
517 V=V-3:Z$="ON":GOTO560
520 V=V-9.8:C=C+1:D1=D1-(V*1.6):GOTO560
530 V=V+9.8:C=C-1:D1=D1-(V*1.6):GOTO570
540 D1=D1-(V*.5):D2=D2-(V*.1):GOTO570
550 D1=D1-(V*.5):D2=D2+(V*.1):GOTO570
560 D1=D1-((V*100+C)/60)
570 IFT1>10THENT1=10
572 IFT1<=0THENV=V-5:T1=0
575 F1=F1-(T1*1.5):H1=H1+(.0392*C*V):DS=DS-H1:IFV>500THENV=V-10
577 IFF1<0THENF1=0
578 IFH1<0THENH1=0
```

(listing continued on page 81)

(listing continued from page 79)

```
580 IFC>0THENC=C-.5
582 IFC<0THENC=C+.5
584 IFV>T1*50THENV=V-(V*.005)
595 D1=INT(D1):D2=INT(D2):F1=INT(F1):V=INT(V):H1=INT(H1):DS=INT(-DS)
596 POKE827,255:POKE821,1:SYS38000:GOSUB3280
597 IFF1<=30THENGOSUB1000
600 IFD1<2000ANDD2>100ORD2<-100)THENGOSUB1100
601 IFH1<=0ANDD1>9999THENPRINT"MAYDAY-MAYDAY DITCHING INTO SEA":GOTO5100
602 IFH1<=0ANDD1>4999THENPRINT"NOSE DIVE BEFORE REACHING RUNWAY":GOTO5100
603 IFV<100THENGOSUB1200
605 IFH1<2500ANDD1<8000THENGOSUB1300:GOTO635
606 IF H1<1000ANDD1<10000THEN612
610 REM PRINT"":FORA=1TO 5:PRINT"                                  ":NEXTA
611 GOTO635
612 SK=INT(RND(0)*4)
613 IFH1<1000ANDH1>750THEN620
614 IFH1<=750ANDH1>500THEN622
615 IFH1<=500ANDH1>250THEN624
616 PRINT""
617 FORR=1TO4:FORE=1TO4:FORW=1TOSK:PRINT"/";:NEXTW:PRINT"/";:NEXTE,R
618 GOTO635
620 PRINT"":FORA=1TOSK:PRINT"OOOOOOOOOOOO.....XXXXXXXX";:NEXTA
621 GOTO635
622 PRINT"":FORA=1TOSK:PRINT"VVV";:NEXTA
623 GOTO635
624 PRINT"":FORA=1TOSK:PRINT"";:NEXTA
635 GOSUB4000
639 IFD1<0ANDH1>0ANDABS(D2)<100THEN5400
680 GOTO500
1000 GOSUB1255:REM ILLEGAL QUANTITYILLEGAL QUANTITY FUEL SUBROUTINE STEPSTEP
1010 PRINT"":FORE=1TO6:PRINT"";
1020 PRINT"LOW FUEL":FORA=1TO40:NEXTA
1030 PRINT"LOW FUEL":FORA=1TO40:NEXTA:NEXTE:Z=Z-5:PRINT""
1040 IFF1<=0THENT1=0
1050 RETURN
1100 GOSUB1255:REM ILLEGAL QUANTITYILLEGAL QUANTITY MOUNTAIN SUB STEPSTEP
1110 IFD1<=0THEN5300
1120 PRINT"":FORF=1TO6:B=1:PRINT"";
1130 PRINT"MOUNTAINS":FORA=1TO40:NEXTA
1140 PRINT"MOUNTAINS":FORA=1TO40:NEXTA:NEXTF:PRINT"";
1150 FOR I=2TO13:POKE733,20-I:POKE734,I:POKE820,6:POKE821,1:POKE731,I+I:SYS3840
0
1160 NEXT:SYS38400:POKE719,127:POKE733,1:POKE731,38:SYS38400:POKE719,104
1180 RETURN
1200 GOSUB1255:REM ILLEGAL QUANTITYILLEGAL QUANTITY STALLING ROUTINE STEPSTEP
1210 PRINT"":FORG=1TO6:PRINT"";
1220 PRINT"STALL":FORA=1TO40:NEXTA
1230 PRINT"STALL":FORA=1TO40:NEXTA:NEXTG:Z=Z-10
1240 H1=H1-35:T1=0:A1=A1+28:IFH1<=0THEN5200
1250 PRINT"                 ":PRINT"";:RETURN
1255 FORR5=0TO24:POKE54272+R5,0:NEXT
1257 POKE54273,130:POKE54277,9:POKE54285,30:POKE54296,15
1259 FORR5=1TO 2:POKE54276,21:FORT6=1TO200:NEXT:POKE54276,20
1260 IFE4=1THEN:NEXT:RETURN
1261 GOSUB7000:NEXT:RETURN
1300 GOSUB1255:REM** LOW ALTITUDE**
1310 IFD1>=5000THEN1400
1320 IFD1<5000ANDABS(D2)>100THENZ=Z+2:R9=9:GOTO2060
1330 IFD1<5000ANDD1>=3000ANDABS(D2)<=100THEN1600
1340 IFD1<3000ANDD1>=1000ANDABS(D2)<=100THEN1700
1350 IFD1<1000ANDD1>=1200ANDABS(D2)<=100THEN1800
1360 IFD1<1200ANDD1>=600ANDABS(D2)<=100THEN1900
1370 IFD1<600ANDD1>0ANDABS(D2)<=100THEN2000
1400 R9=8:GOSUB4500
1410 IFH1<=0THEN5000
1420 GOTO2060
1600 Z=Z+5:R9=10:GOTO2060
1700 Z=Z+6:R9=11:GOTO2060
1800 Z=Z+10:R9=12:GOTO2060
1900 Z=Z+15:R9=13:GOTO2060
2000 Z=Z+20:R9=15:IFH1<=0THEN5060
2060 IFH1<=0THEN5060
2100 RETURN
3000 REM START
3005 K=197:POKE53280,3:POKE53281,16
3006 POKE54296,15:DW=0:GOSUB9100
3010 PRINT"     FLIGHT BA172   LONDON-NAPOLI"
3015 PRINT"
3020 PRINT"CONTROLS"
3025 PRINT"
3030 PRINT"'B'   REV THRUST  'Z'  LANDING GEAR DOWN"
3040 PRINT"'S'     SLOWER    'F'    FASTER"
3050 PRINT"           'W'(UP)   "
3060 PRINT"(LEFT)'A'--+--'D'(RIGHT)"
3070 PRINT"              'X'(DOWN)"
3075 PRINT"    S C O R E  "0
3080 PRINT"   PRESS  SPACE-BAR   TO CONTINUE"
3090 GETA$:IFA$<>" "THEN3090
3100 LA$=""
3130 AA$="                  "
3170 D2=(INT(RND(5)*300)-150)*9:U$="UP":D=0:PRINT"":Z$="OFF"
3180 F1=700:T1=5:V=T1*50:D1=(INT(RND(2)*100)+300)*100
3190 H1=INT(RND(5)*750)+300:C=0:Z=0
3200 GOTO3400
3210 GOSUB1255:REM STEPSTEP  LOAD INITIAL DISPLAY ILLEGAL QUANTITYILLEGAL QUANT
ITY
3220 FORA=1TO6:PRINT"                                     ":NEXTA
3225 PRINT"___________________________________":PRINT"";
3230 PRINTAA$:PRINT"A/R SPEED         DISTANCE         "
3235 PRINTLA$:PRINT"V.S.I            COMPASS          "
3240 PRINTLA$:PRINT"THRUST           ALTITUDE          ":PRINTLA$
3250 PRINT"FUEL          REV THRUST           ":PRINTLA$
3270 PRINT"                                    ":PRINT"LANDING GEAR "U$
3275 RETURN
3280 REM ILLEGAL QUANTITYILLEGAL QUANTITY INDICATOR PANEL STEPSTEP
3281 PRINT""
3290 PRINT"                                 "
3298 IFV>220ANDV<280THENPRINT"";:GOTO3301
3299 IFD1<5000THENPRINT"";:GOTO3301
3300 PRINTTAB(11);V;TAB(30);D1:PRINT"":GOTO3310
3301 PRINTTAB(11)"";V;TAB(30);D1:PRINT""
3310 PRINT"                                 "
3319 IFD2<100ANDD2>-100THEN3322
3320 PRINTTAB(13)"";DS;TAB(32);D2:GOTO3330
3322 PRINTTAB(13);DS;TAB(31);:PRINT "";D2:PRINT"";
3330 PRINT"                                 "
3340 PRINTTAB(13)T1;TAB(31)H1;
3350 PRINT"                                 "
3360 PRINTTAB(11)F1;TAB(31);Z$:PRINT"              "U$
3372 GOSUB7000:RETURN
3400 GOSUB3210:GOSUB3280:GOTO500
4000 REM WINDOW
4001 IFH1<1000ANDD1<2500THEN4500
4002 IFD1<40000ANDD1>10000THEN4100
4010 POKE719,127:POKE735,9
4015 FOR I=2TO5:POKE733,20-I:POKE734,I-2:POKE820,6:POKE821,3:POKE731,I+I
4016 SYS38400:POKE736,7
4020 NEXT:POKE719,102:POKE733,1:POKE731,38:SYS38600:POKE719,160:POKE735,15
4025 FOR I=4TO11:POKE733,23-I:POKE734,I:POKE820,8:POKE821,3:POKE731,I+I-6
4030 SYS38400:NEXTI
4040 FORI=0TO2:POKE1477+I,215:POKE1487+I,215
4050 POKE1399+I,215:POKE55695+I,10
4060 POKE1406+I,215:POKE55702+I,10:NEXTI
4099 GOTO4370
4100 POKE821,3:POKE733,1:POKE734,1
4120 H9=5+(DS/10):IFH9>9THENH9=9
4130 IFH9<1THENH9=1
4140 POKE731,38:POKE736,H9:POKE719,160:POKE735,3:SYS38600:POKE734,H9
4150 POKE736,1:POKE735,15:POKE719,104:SYS38600:POKE719,160:POKE734,H9+1
4160 POKE736,10-H9:POKE735,14:SYS38600
4220 POKE736,5:POKE734,5
4240 D9=INT(D2/50):IFD9>16THEND9=16
4250 IFD9<-16THEND9=-16
4260 POKE733,D9+23:POKE731,1:POKE734,1:POKE719,93:POKE736,9:POKE735,1
4270 SYS38600:POKE736,0
4275 D8=D9+14:IFD8<0THEND8=0
4280 IFD1>30000THENRETURN
4287 POKE719,123:POKE733,D8+5:POKE735,4:POKE731,3:POKE734,H9:SYS38600
4290 IFD1>25000THENRETURN
4295 POKE719,104:POKE733,D8:POKE735,0:POKE731,12:POKE734,H9:SYS38600
4300 IFD1>20000THEN4370
4310 POKE719,127:POKE733,12:POKE735,4:POKE731,16:POKE734,H9+1:SYS38600
4315 IFD1>18000THEN4370
4320 POKE733,8:POKE731,24:POKE734,H9+2:POKE719,80:POKE735,8:SYS38600
4330 IFD1>17000THEN4370
4340 POKE733,2:POKE731,36:POKE734,H9+3:POKE719,65:POKE735,5:SYS38600
4350 IFD1>16000THEN4370
4360 POKE733,1:POKE731,38:POKE734,H9+4:POKE719,80:POKE735,8:POKE736,2:SYS38600
4370 D7=INT(D2/4):IFD7>16THEND7=16
4380 IFD7<-16THEND7=-16
4390 POKE733,D7+20:POKE731,1:POKE734,1:POKE719,93:POKE736,9:POKE735,2
4400 SYS38600:POKE736,0
4499 RETURN
4500 FOR I=2TO8:POKE733,20-I:POKE734,I-2:POKE820,6:POKE821,3:POKE731,I+I
4510 POKE719,95:SYS38400:POKE736,2
4520 NEXT:POKE719,127:POKE733,1:POKE731,38:SYS38600:POKE719,160:POKE735,R9
4525 FOR I=8TO11:POKE733,20-I:POKE734,I-2:POKE820,8:POKE821,3:POKE731,I+I-2
4530 SYS38400:NEXTI
4540 FORI=0TO2:POKE1470+I,215:POKE1497+I,215
4550 POKE1392+I,215
4560 POKE1412+I,215:NEXTI
4599 GOTO4370
4900 REM END OF EFFECTS
4999 RETURN
5000 PRINT" FLIGHT RECORD"
5005 GOSUB9000:FORL=SSTOSS+24:POKEL,0:NEXTL
5010 FORM=1TO1000:NEXTA:PRINT"":POKEK,0
5020 PRINT"CRASH LAND - SPEED-";V;"KMH":Z=Z-75
5030 PRINT"";D1;"METERS FROM RUNWAY AND ";D2
5040 PRINT"METERS OFF CENTRE.THE AIRCRAFT BROKE  UP "
5045 IFU$<>"UP"ANDA1<200THENPRINT"EVERYONE WAS KILLED      ":Z=0:GOTO6000
5060 FORA=1TO2000:NEXTA:PRINT"":POKE733,1:POKE734,13:POKE736,10:SYS3860
0
5065 POKEK,0:FORA=54272TO54296:POKEA,0
5070 IFABS(D2)<20THENPRINT"FLIGHT BA172 HAS LANDED ";D2"METERS "
5075 IFABS(D2)<20THENPRINT"OFF CENTRE AND";D1;"FROM THE TERMINAL":Z=Z+35
5080 IFABS(D2)>20THENPRINT"YOU MUST WAIT FOR THE BUS ,YOU ARE"
5085 IF ABS(D2)>20THENPRINT"";D2;"METERS FROM ARRIVALS AND";D1;"METERS"
5087 IFABS(D2)>20THENPRINT"FROM THE ":Z=Z+12
5090 PRINT"AIRPORT,YOUR LANDING SPEED WAS";V;"KMH,"
5100 IFU$<>"DOWN"THENPRINT"YOUR UNDER-CARRIAGE WAS NOT DOWN THE"
5105 IFU$<>"DOWN"THENPRINT"PLANE HAS BROKEN UP":Z=Z-55
5110 IFV<250THEN6000
5120 IFV>280ANDV<400THEN PRINT"TOO FAST":Z=Z-45:GOTO5150
5130 IFV>400THENPRINT"TOO FAST YOUR SPEED WAS TOO HIGH,THE";
5140 IFV>400THEN PRINT"PLANE COLLAPSED":Z=Z-80:GOSUB9000
5150 GOTO6000
5200 PRINT"THE AIRCRAFT STALLED CRASHING ON ITS"
5210 PRINT"NOSE,THERE ARE NO SURVIVORS."
5220 PRINT"YOU WERE";D2;"METERS OFF-CENTRE"
5230 PRINT"AND";D1;"METERS FROM THE RUNWAY,":Z=Z-150:GOSUB9000:GOTO6000
5300 PRINT"THE PLANE HAS HIT A MOUNTAIN AT";A1:GOSUB9030
5305 FORZ1=54272TO54296:POKEZ1,0:NEXTZ1
5310 PRINT"M.":Z=Z-200
5320 PRINT"YOU WERE";D2"METERS OFF-CENTRE.":GOTO6000
5400 PRINT"YOU OVERFLEW THE RUNWAY AND CRASHED":Z=Z/100
6000 REM**SCORE**
6005 FORC=54272TO54296:POKEC,0
6010 PRINT""
6020 PRINT""
6060 Z=Z+INT(200/(ABS(D1)+1)+(150/(ABS(D2)+2))+(F1/15)+(30-H1/150))
6065 IFZ<0THENZ=0
6070 E4=1:GOSUB1255:E4=0:PRINT"YOU SCORED";INT(Z);"POINTS.":IFZ>0THENO=Z
6071 FORC=54272TO54296:POKEC,0:NEXT:POKE53281,1
6075 PRINT"YOUR SCORE  ";O:POKEK,0
6076 PRINT"DO YOU WANT ANOTHER GO"
6077 GETA$:IFA$=""THEN6077
6078 IFA$<>"Y"ANDA$<>"N"THEN6077
6079 IFA$="Y"THENPRINT"":GOTO3070
6080 POKEK,0:PRINT"":END
7000 SS=54272:POKE54296,15
7005 IFD1>10000THEN7020
7010 POKESS+5, 7:POKESS+6,236:POKESS+12,7:POKESS+13,255
7011 POKESS+19, 7:POKESS+20,255
7015 GOTO7033
7020 POKESS+5, 3:POKESS+6,255:POKESS+12, 7:POKESS+13,255
7021 POKESS+ 7,15:POKESS+20,255
7033 IFD1<10THEN7080
7034 RF=V+F1+D1:IFRF>25000ORRF<1000THENRF=20000:RH%=RF/256:RL%=RF-256*RH%
7035 HF=D1/.6097:O=INT(V/2):FR=V*60:IFFR>30000THENFR=30000
7040 HF%=HF/256:LF%=HF-256*HF%:HH%=FR/256:LL%=FR-256*HH%
7050 POKESS+1,HF%:POKESS,LF%:POKESS+8,HH%:POKESS+7,LL%
7051 POKESS+15,RH%:POKESS+14,RL%
7060 POKESS+4,129:POKESS+11,33:POKESS+18,129:POKESS+2,7:POKESS+3,7
7080 RETURN
8000 FORW=15TO0STEP-5:POKE54277,40:POKE54296,W:POKE54273,40:POKE54272,200
8010 POKE54276,129:NEXTW:DW=1:RETURN
9000 REM EXPLODE
9001 FORX=2000TO24000STEP3000:V=X/.6097:VH%=V/256:VL%=V-256*VH%:FORW=1TO15
9010 POKE54296,15:NEXTW:POKE54277,5:POKE54278,236:POKE54273,VH%:POKE54272,VLX
9020 POKE54276,129:POKE54296,0:NEXTX
9030 FORX=8000TO20000STEP3000:V=X/.6097:VH%=V/256:VL%=V-256*VH%:FORW=1TO45
9040 POKE54296,15:NEXTW:POKE54277,5:POKE54278,236:POKE54273,VH%:POKE54272,VLX
9050 POKE54276,129:POKE54296,0:NEXTX
9060 RETURN
9100 PRINTSPC(1)"         FLIGHT CONTROL"
9102 PRINTSPC(1)"   YOU ARE APPROACHING NAPOLI AIRPORT"
9103 PRINTSPC(1)"  YOU NEED TO TAKE CONTROL OF THE    "
9104 PRINTSPC(1)"  AIRCRAFT. THE DISTANCE FROM THE    "
9105 PRINTSPC(1)"  AIRPORT IS SHOWN IN THE TOP RIGHT "
9106 PRINTSPC(1)"  OF YOUR INSTRUMENT PANEL WHICH IS "
9107 PRINTSPC(1)"  IMMEDIATELY BELOW YOUR WINDSCREEN."
9108 PRINTSPC(1)"  YOUR AIRSPEED ALTITUDE & POSITION."
9109 PRINTSPC(1)"  TOGETHER WITH ALL THE DATA NEEDED "
9110 PRINTSPC(1)"  TO LAND ON THE RUNWAY IS DISPLAYED."
9111 PRINTSPC(1)"     ANY KEY TO CONTINUE    ":GOSUB9199
9112 PRINTSPC(1)"   YOUR INSTRUMENT PANEL HAS ALARMS.  "
9113 PRINTSPC(1)"  WHEN YOU ARE WITHIN CORRECT LIMITS"
9114 PRINTSPC(1)"  THE VALUES ARE DISPLAYED IN GREEN."
9115 PRINTSPC(1)"  CRITICAL ALARMS ARE IN RED WITH   "
9116 PRINTSPC(1)"  AN AUDIO ALARM. WHEN YOUR ALTITUDE"
9117 PRINTSPC(1)"  REACHES 1000 METERS YOU CAN LOWER "
9118 PRINTSPC(1)"  YOUR UNDERCARRIGE. YOUR DIRECTION "
9119 PRINTSPC(1)"  LEFT SHOWN (-) OR RIGHT (NORMAL) IS"
9120 PRINTSPC(1)"  CORRECTED BY KEY A OR D SEE BELOW ."
9121 PRINTSPC(1)"  AS YOU GET NEAR THE RUNWAY THE CITY"
9122 PRINTSPC(1)"  WILL APPEAR IN YOUR WINDSCREEN     "
9123 PRINTSPC(1)"         HAPPY LANDING !          "
9125 PRINTSPC(1)"     ANY KEY TO CONTINUE   "
9130 GOSUB 9199
9138 RETURN
9199 GETA$:IFA$=""THEN9199
9200 RETURN
10000 DATA169,24,205,222,2,16,1,96,162,255,169,4,141,252,0, 169
10001 DATA0,141,251,0,169,0,141,253,0,169,216,141,254,0,169, 40
10002 DATA24,109,251,0,141,251,0,169,0,109,252,0,141,252,0, 232
10003 DATA236,222,2,208,233,162,255,169,40,24,109,253,0,141,253, 0
10004 DATA169,0,109,254,0,141,254,0,232,236,222,2,208,233,162, 0
10005 DATA173,52,2,141,32,208,173,53,2,141,33,208,169,255,141, 225
10006 DATA2,172,221,2,172,207,2,145,251,173,223,2,145,253,232, 208
10007 DATA236,219,2,208,239,169,40,24,109,251,0,141,251,0,169, 0
10008 DATA109,252,0,141,252,0,169,40,109,253,0,141,253,0,169, 0
10009 DATA109,254,0,141,254,0,238,225,2,173,225,2,162,0,205, 224
10010 DATA2,208,190,96,255,15,240,0,255,15,240,0,255,15,240, 48
```



FROGGIE

ZX-81

R Braunton gives you a leaping game for a leap year.

FROGGIE IS A VERSION of the well known arcade game for the 16K ZX-81 with these features:

- Fast machine code action;
- Moving cars, lorries and racing cars;
- Moving logs and turtiles;
- Alligators and diving turtles;
- Flies and alligators in the homes;
- Snake on the bank;
- Baby frog to rescue;
- Time bar;
- Extra frog at 8000 points;
- Hold key.

The machine code itself is stored in a Rem 6208 bytes long. This is obtained by entering the first line:

1 REM 153 characters

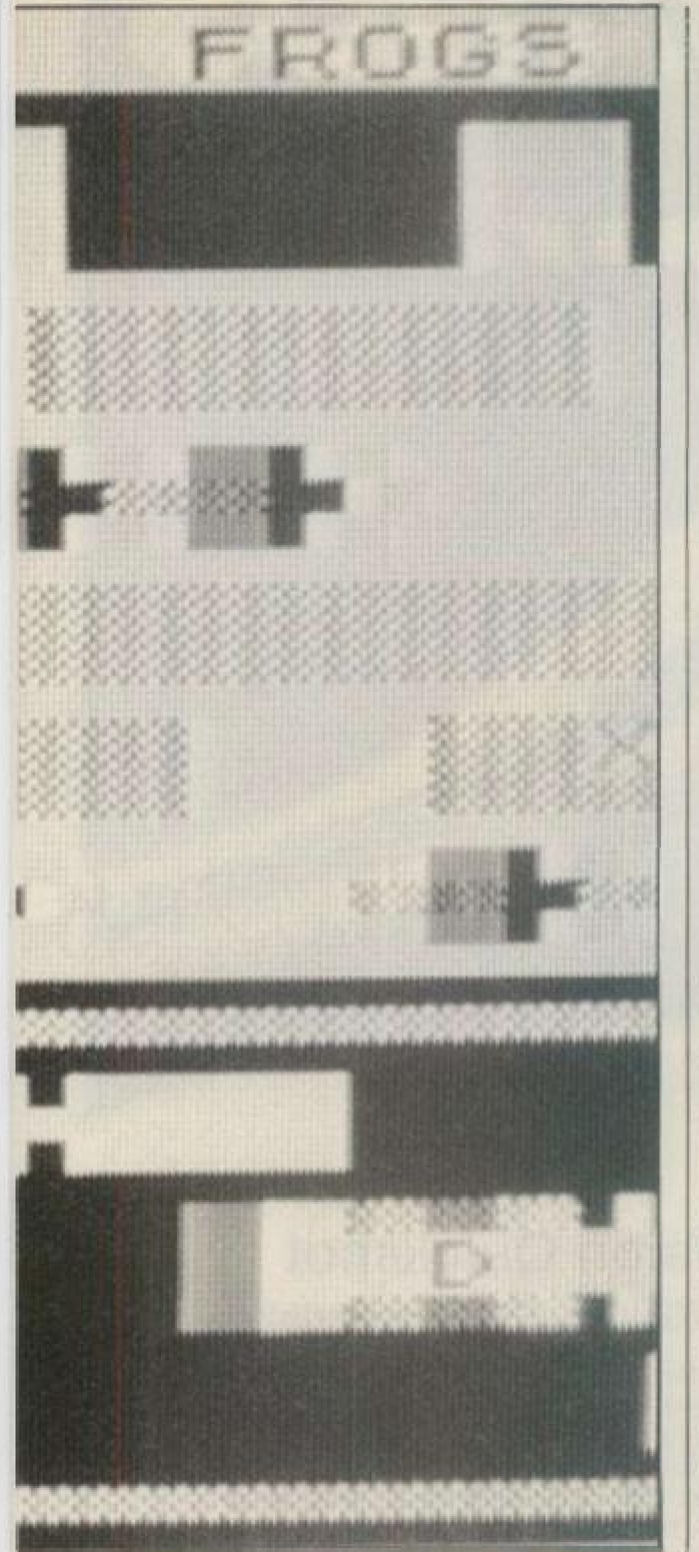
Then edit the line and change it to line 2, then edit this and change it to line 3. Carry on this procedure until you have lines 1 to 39. Then add:

40 REM 6 characters

and then enter the following commands:

```
POKE 16510,0
POKE 16511,65
POKE 16512,24
```

This will result in all the Rems becoming one large Rem of 6208 characters. Now type in the hexidecimal loader, program 1. Run it and type in the machine code but missing out the first column as this is the address at which




```
9900 INPUT S
9910 INPUT F
9920 FOR N=S TO F STEP 8
9930 PRINT TAB 0;N;" - ";
9940 FOR B=N TO N+7
9950 LET P=PEEK B
9960 PRINT CHR$ (28+INT (P/16));
CHR$ (28+P-16*INT (P/16));
9970 NEXT B
9980 PRINT
9990 NEXT N
```

the code is stored. The numbers are entered from left to right and can be either entered one by one or a number of them together but they must be entered in pairs and not as single characters. Once the machine code has been entered, type s to stop the program and then Save the program a few times on tape.

Then type the following lines:

```
10 SAVE "FROGGIE"
20 LET L = USR 22160
30 CLS
```

Now type GOTO 20. If the program runs as described later in the article then delete the loader program and run the program to Save it. If not then enter program 2, substituting the addresses between which you wish to check for Start and Finish. Type RUN 9900 and check that it agrees with my listing. Then you can correct any mistakes you find by changing the value of A in line 100 to the offending address and enter the correct number. Note that the bytes up to address 16560 need not be 0 as these locations are used as stores and will alter after the program has run once.

On running the program there will be a title sequence telling you to press a key. You control the frog, an inverse X, using the four cursur keys. The object is to fill the homes at the top of the screen. To get there you must avoid the traffic on the road and jump onto the logs and turtles to cross the river, but watch out for the diving turtles and alligators. You are racing against time which is shown at the bottom of the screen and you will gain a bonus for the time remaing after filling a home.

On the first sheet there isn't very much traffic and there are many logs and turtles but as you go through more sheets there are less and shorter logs and more traffic including fast racing cars after the second sheet. A snake, an inverse s, patrols the banks after the first sheet.

On the first sheet there are also flies, inverse fs, which appear in the homes occasionally and can be eaten for extra points. But after the first sheet alligators appear in the homes and must be avoided when they are fully in the home.

You can also rescue a baby frog for extra points.

Scoring is as follows:

Jumping forward	10
Jumping backwards	-10
Filling one home	100
Filling all five homes	1000
Baby frog	50
Flies	50

You also score 10 times the amount of time you have left after filling a home. The game can be held by pressing H and started again by pressing S.

It is a little difficult to get into the leftmost home at first but becomes easy after a few games. To get in you must do two quick hops off the turtles onto the logs and into the home just as the turtle moves you onto the far left position.

If you do not want to type in the program but would like a copy of it then send £3 to: Mr R Braunton, 36 Broad Lane, Illogan, Redruth, Cornwall TR15 3HY.

Program 1.

```
 99 REM ***HEX LOADER***
100 CLS
130 PRINT "START ADDRESSS"
140 INPUT S
150 PRINT "FINISH ADDRESS"
160 INPUT F
180 FOR N=S TO F STEP 8
190 LET T=0
195 SCROLL
200 PRINT N;" - ";
210 INPUT A$
220 PRINT A$;" = ";
230 INPUT TOT
240 PRINT TOT
245 LET Z=0
250 FOR K=1 TO LEN A$ STEP 2
260 LET C=(CODE A$(K)-28)*16-CO
DE A$(K+1)-28
270 LET T=T+C
280 POKE N+Z,C
290 LET Z=Z+1
300 NEXT K
310 IF TOT=T THEN GOTO 340
320 SCROLL
325 PRINT "ERROR - PLEASE INPUT
AGAIN"
330 GOTO 190
340 NEXT N
350 STOP
```

Hex dump.

16514 -	[illegible]	= 203	16762 -	1B1B1B1B1B1B1B1B	= 216	17026 -	FE8C0810FE762804	= 915	17290 -	000000000000FE01	= 255
16522 -	[illegible]	= 14	16770 -	1B1B1B1B1B1B1B1B	= 216	17034 -	10F4183E112120A7	= 863	17298 -	[illegible]	= 319
16530 -	[illegible]	= 492	16778 -	1B1B1B0000000000	= 81	17042 -	ED5218F43A89405F	= 941	17306 -	[illegible]	= 683
16538 -	0000000000000000	= 0	16786 -	003A8340FE042004	= 547	17050 -	FE09CAA25A3A8240	= 977	17314 -	[illegible]	= 1050
16546 -	0000000000000000	= 0	16794 -	[illegible]	= 414	17058 -	FE01CA1947FE02CA	= 1011	17322 -	[illegible]	= 704
16554 -	000000000000002A	= 42	16802 -	[illegible]	= 1082	17066 -	[illegible]	= 709	17330 -	[illegible]	= 1128
16562 -	[illegible]	= 430	16810 -	[illegible]	= 851	17074 -	[illegible]	= 652	17338 -	[illegible]	= 948
16570 -	[illegible]	= 400	16818 -	[illegible]	= 993	17082 -	[illegible]	= 806	17346 -	[illegible]	= 1275
16578 -	[illegible]	= 781	16826 -	[illegible]	= 359	17090 -	[illegible]	= 947	17354 -	[illegible]	= 763
16586 -	[illegible]	= 857	16834 -	[illegible]	= 885	17098 -	[illegible]	= 956	17362 -	[illegible]	= 1057
16594 -	[illegible]	= 734	16842 -	[illegible]	= 591	17106 -	[illegible]	= 632	17370 -	[illegible]	= 1187
16602 -	[illegible]	= 508	16850 -	[illegible]	= 666	17114 -	[illegible]	= 831	17378 -	[illegible]	= 687
16610 -	0000000000000000	= 0	16858 -	[illegible]	= 1015	17122 -	[illegible]	= 223	17386 -	[illegible]	= 1176
16618 -	0000000000000000	= 0	16866 -	[illegible]	= 456	17130 -	[illegible]	= 859	17394 -	[illegible]	= 466
16626 -	[illegible]	= [illegible]	16874 -	[illegible]	= 310	17138 -	[illegible]	= 1187	17402 -	[illegible]	= 216
16634 -	[illegible]	= [illegible]	16882 -	[illegible]	= 241	17146 -	[illegible]	= 874	17410 -	[illegible]	= 749
16642 -	[illegible]	= 1138	16890 -	[illegible]	= 745	17154 -	[illegible]	= 973	17418 -	[illegible]	= 769
16650 -	[illegible]	= 1018	16898 -	[illegible]	= 850	17162 -	[illegible]	= 802	17426 -	[illegible]	= 833
16658 -	[illegible]	= 109	16906 -	[illegible]	= 611	17170 -	[illegible]	= 833	17434 -	[illegible]	= 792
16666 -	[illegible]	= [illegible]	16914 -	[illegible]	= 673	17178 -	[illegible]	= 948	17442 -	[illegible]	= 849
16674 -	[illegible]	= [illegible]	16922 -	[illegible]	= 887	17186 -	[illegible]	= 926	17450 -	[illegible]	= 1032
16682 -	[illegible]	= [illegible]	16930 -	[illegible]	= 669	17194 -	[illegible]	= 856	17458 -	[illegible]	= 1155
16690 -	[illegible]	= 1046	16938 -	[illegible]	= 474	17202 -	[illegible]	= 932	17466 -	[illegible]	= 782
16698 -	[illegible]	= [illegible]	16946 -	[illegible]	= 732	17210 -	[illegible]	= 861	17474 -	[illegible]	= 1097
16706 -	[illegible]	= [illegible]	16954 -	[illegible]	= 786	17218 -	[illegible]	= 1015	17482 -	[illegible]	= 891
16714 -	[illegible]	= 1012	16962 -	[illegible]	= 835	17226 -	[illegible]	= 854	17490 -	[illegible]	= 863
16722 -	[illegible]	= 838	16970 -	[illegible]	= 505	17234 -	[illegible]	= 1025	17498 -	[illegible]	= 683
16730 -	[illegible]	= 880	16978 -	[illegible]	= 733	17242 -	[illegible]	= 851	17506 -	[illegible]	= 1119
16738 -	[illegible]	= 627	16986 -	[illegible]	= 892	17250 -	[illegible]	= 1049	17514 -	[illegible]	= 711
16746 -	[illegible]	= 1007	16994 -	[illegible]	= 1023	17258 -	[illegible]	= 932	17522 -	0000000000000000	= 0
16754 -	[illegible]	= 376	17002 -	[illegible]	= 915	17266 -	[illegible]	= 1017	17530 -	[illegible]	= 737
			17010 -	[illegible]	= 1046	17274 -	[illegible]	= 863			
			17018 -	[illegible]	= 503	17282 -	[illegible]	= 878			

(listing continued on page 85)

GET YOUR HANDS ON ONE...



The

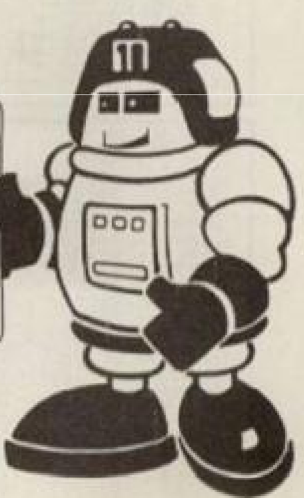
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...BEFORE THEY DO!

(listing continued from page 83)

[illegible]

FREEWAY FROG

FREEWAY FROG is a game for the BBC Micro model B, based on the arcade game Frogger. The program has been tested and works with both the 0.1 and the 1.2 Operating Systems. It also works on a Model A, fitted with 32K RAM. The program demonstrates how machine code can be used to generate multi-colour graphics quickly and easily. Before I go into how the program works, I will give a brief description of how to play the game.

Freeway Frog is a game for one player where you must lead your family of frogs safely across the multi-lane motorway dodging the traffic. You must also cross a treacherous and fast-moving river with many currents to catch

Listing 1.

```
10 REM
20 REM      Frogger
30 REM
40 REM      1st of three parts
50 REM
60 REM      by  J.R.Wilson
70 REM
80 DATA 1,B7A3A3
90 DATA 1,F5F0B0E0A0E0F0A0A0F0B0A0A0A0F0B0A0A0A0F0B
0A0A0A0F0B0A0B0A0F0B0
100 DATA 1,B52020A0BDA12020B6A0A2B4A0B6A0A2B4A0B6A0A
2B420BEF0BAA0EAA6
110 DATA 1,B5A0A0A0B5A0A0A0A9F0B8A1A0A9F0B8B5A0A9F0B
8B5A0A9F0B8A0EA
120 DATA 17,B520A0A0A0B5
130 DATA 14,A2ACA6A0A0A2ACA6
140 MODE7
150 VDU 132,157
160 PRINT
170 FORY=1TO 6
180 READ B
190 READ A$
200 FOR J=0 TO 1
210 H=J*17 +Y
220 PRINT TAB(0,H);
230 IF J=0 THEN VDU 132,157,147 ELSE VDU 130,157,149
240 PRINT SPC(B+1);
250 FORI =1 TO LENA$ STEP 2
260 A=EVAL("&"+MID$(A$,I,2))
270 VDUA
280 NEXT I
290 NEXT J
300 NEXT Y
310 PRINT TAB(0,7);CHR$132;CHR$157
320 PRINTTAB(0,24);CHR$130;CHR$157;
330 PRINT TAB(0,17);CHR$130;CHR$157
340 VDU 31,12,9,129,141,98,121
350 VDU 32,134,74,46,82,46
360 VDU 87,105,108,115,111,110
370 VDU 31,12,10,129,141,98,121
380 VDU 32,134,74,46,82,46
390 VDU 87,105,108,115,111,110
400 SOUND&10,17,3,255
410 FOR I=1 TO 4
420 FOR J=50 TO 255
430 SOUND &11,0,J,1
440 NEXT
450 NEXT
460 SOUND&10,0,0,0
470 VDU 28,10,16,30,11
480 PAGE=&1100
490 CHAIN "Frogger1"
500 END
```

Listing 2.

```
10REM
20REM Frogger part 2
30REM
40REM by J.R.Wilson
50REM
60REM October 10th 1983
70REM
80REM on BBC Model B
90REM
100:
110:
150:
160:
170IF PAGE<>&1100 THEN PRINT"PAGE should be &1100":E
ND
180REM Initialise sound envelopes
190ENVELOPE1,1,1,0,0,20,0,0,127,-2,-3,-5,126,80
200ENVELOPE2,2,-1,-1,-1,255,255,255,126,0,0,-1,126,8
0
210ENVELOPE3,2,0,0,0,0,0,0,126,-1,-3,-5,126,80
220REM Setup user defined characters
230REM Blank
240VDU23,224,255,255,255,255,255,255,255,255
250REM Frog moving up
260VDU23,225,90,165,189,60,24,36,66,36
270REM Frog moving down
280VDU23,226,36,66,36,24,60,189,165,90
290REM Frog moving to right
300VDU23,227,1,66,172,28,28,172,66,1
310REM Frog moving to left
320VDU23,228,128,66,53,88,88,53,66,128
330REM Frog sitting in hole
340VDU23,229,4,10,10,31,63,47,112,63
350VDU23,230,32,80,80,248,252,244,14,252
360VDU23,231,91,103,59,31,47,55,113,224
370VDU23,232,218,230,220,248,244,236,142,7
380REM Dead frog
390VDU23,234,137,74,16,0,3,192,0,0
400VDU23,235,74,145,16,0,0,0,0,0
410REM Snake moving to right
420VDU23,236,0,0,0,0,195,36,24,0
430VDU23,237,0,0,2,7,8,144,96,0
440REM Snake moving to left
450VDU23,238,0,0,64,224,16,9,6,0
460VDU23,239,0,0,0,0,195,36,24,0
470REM Crocodile sitting in hole
480VDU23,240,0,0,0,0,0,0,48,73
490VDU23,241,0,0,0,0,28,120,224,224
500VDU23,242,75,255,254,252,255,255,255,0
510VDU23,243,128,128,0,0,85,255,255,0
520REM Fly
530VDU23,244,40,16,16,84,214,214,214,16
540REM hedge
550VDU23,245,255,187,255,238,255,119,255,221
560MODE7
570PROCL(7,5,CHR$132+CHR$157+CHR$134+"F R O G G E R
"+CHR$156)
580PROCL(8,9,CHR$129+"by"+CHR$130+"J.R.Wilson")
590PROCL(3,13,"Please wait a few seconds..")
600REM Setup machine code in pages &900 and &A00 hex
610FOR I=0 TO 3 STEP 2
620P%=&900
630[OPT I
640\
650\    Move graphics
660\
670.move LDA#0
680STA&8F \ object counter
690.L2 LDX&8F
700LDA YP,X
710CMP#0
720BNE L1
730.L4 LDA&8F
740INC&8F
750CMP#30
760BNE L2
770RTS
780.L1 LDA T,
790TAY
800LDA LB,Y
810STA&72
820LDA HB,Y
830STA&73
840LDA LE,Y
850STA&74
860LDA SP,Y
870STA&75
880LDA YP,X
890STA&77
900LDA XP,X
910STA&76
920JSR poke
930CLC
940LDA&76
950ADC&75
960STA&76
970CMP#79
980BNE L3
990.L12 LDA#0
1000STA&76
1010JMP L11
1020.L3 CMP#80
1030BEQ L12
1040CMP#78
1050BEQ L12
1060CMP#0
1070BNE L11
1080LDA#78
1090STA&76
1100.L11 STA XP,X
1110JSR poke
1120JMP L4
1130\
1140\
1150\
1160.poke TXA
1170PHA
1180.DX&77
1190LDA LSB,X
1200STA&80
1210LDA MSB,X
1220STA&81
1230LDA&76
1240CMP#0
1250BEQ P1
1260.DX#8
1270.P2 CLC
1280LDA&80
1290ADC&76
1300STA&80
1310LDA&81
1320ADC#0
1330STA&81
1340DEX
1350BNE P2
1360.P1 LDY#0
1370STY&82
1380STY&83
1390STY&84
1400STY&85
1410.P3 LDY&84
1420LDA(&72),Y
1430LDY&85
1440EOR(&80),Y
1450STA(&80),Y
1460INC&84
1470INC&85
1480LDA&82
1490INC&82
1500CMP#7
1510BNE P3
1520LDA#0
1530STA&82
1540INC&83
1550CLC
1560LDA&83
1570ADC&76
1580CMP#80
1590BNE P4
1600LDY&77
1610LDA LSB,Y
1620STA&80
1630LDA MSB,Y
1640STA&81
1650LDA#0
1660STA&85
1670.P4 LDA&83
1680CMP&74
1690BEQ P5
1700JMP P3
1710.P5 PLA
1720TAX
1730RTS
1740\
1750\
1760\
1770.peek LDA LSB,Y
1780STA&70
1790LDA MSB,Y
1800STA&71
1810STX&72
1820CPX#0
1830BEQ O9
1840LDX#8
1850.O10 CLC
1860LDA&70
1870ADC&72
1880STA&70
1890LDA&71
1900ADC#0
1910STA&71
1920DEX
1930BNE O10
1940.O9 LDY#0
1950STY&74
1960.O11 LDA(&70),Y
1970STA&73
1980CMP#0
1990BEQ O13
2000AND#170
2010CMP#0
2020BEQ O12
2030AND#128
2040CMP#128
2050BEQ O12
2060INC&74
2070.O12 LDA&73
2080AND#85
2090CMP#0
2100BEQ O13
2110AND#64
2120CMP#64
2130BEQ O13
2140INC&74
2150.O13 INY
2160CPY#32
2170BNE O11
2180RTS
2190]
2200LSB=P%+1
2210MSB=LSB+32
2220HB=MSB+32
2230LB=HB+13
2240LE=LB+13
2250SP=LE+13
2260XP=SP+13
2270YP=XP+30
2280T=YP+30
2290NEXT
2300REM
2310FORI=0 TO 31
2320LSB?I=(&3000+I*640)MOD256
2330MSB?I=(&3000+I*640)DIV256
2340NEXT
2350REM Data for special graphics
        characters
2360REM i.e. The sprite data
2370REM LOG
2380DATA E2E2C0C0C0C0E2E2
2390DATA C0C0C0C0C0C0C0C0
2400DATA C0C4C0C0C0C0C0CC
2410DATA C0C8C0C0C0C0C0C0
2420DATA C0C0C0C0C4C0C4C0
2430DATA CCC0C0C0C8C0C8C0
2440DATA C0C0C4C0C0C0C0C0
2450DATA C0C0C8C0C0C0CCC0
2460DATA C0C4C0C4C0C0C0C0
2470DATA C0C8C0C8C0C0C0C0
2480DATA C4C0C4C0C0C0C0C4
2490DATA C8C0C8C0C0C0C0C8
2500DATA C0C0C0C0C0C0C0C0
2510DATA C0C1C1C1C1C1C1C0
2520DATA D3C3C3C1C1C3C3D3
2530REM CROC
2540DATA F3F3F3F3F3F3F3F3
2550DATA F3F3F3C0C0F3F3
2560DATA F3F3F3C8C0C0F3F3
2570DATA F3F3C8C4C0C3F3F3
2580DATA F3E2C0C4C0C0C0C0
2590DATA F3C8C4C0C0C1D1D1
2600DATA F3C0C0C4C0C3F3F3
2610DATA F3C4C8C0C0C3F3F3
2620DATA F3F3C0C8C0C3E2E2
2630DATA F3F3F3C4C0C0C0C0
2640DATA F3A3030303033F3F3
2650DATA 53B303030343F3F3
2660DATA 3030B30303C33030
2670DATA 303030303B3C33030
2680DATA 303030303B3C33030
2690REM LORRY (
2700DATA 00153A3A3A3A1500
2710DATA 3F3A3F3F3F3F3A3F
2720DATA 2A2A2A2A2A2A2A2A
2730DATA 3F2F2F2F2F2E2F3F
2740DATA 3F0F0F1E0F0F0F3F
2750DATA 3F0D0F0F0F0F253F
2760DATA 3F0F0F270F270F3F
2770DATA 3F0F0B0F1E1E0F3F
2780DATA 3F0F0F0F0F0F0F3F
2790DATA 3F151F1F1F1F1F3F
2800REM FAST CAR )
2810DATA 0103030202030301
2820DATA 3C0302030302033C
2830DATA 0303010303010303
2840DATA 1403020202020314
2850DATA 2903030101030329
2860DATA 0002030303030200
2870REM BIKE )
2880DATA 0000000303000000
2890DATA 0000001212000000
2900DATA 0000150F0F150000
2910DATA 003F000C0C003F00
2920DATA 0000282929280000
2930DATA 0000000303000000
2940REM TRACTOR (
2950DATA 0000023C3C020000
2960DATA 000101 3E3C010100
2970DATA 0003033C3C030303
2980DATA 0505100505100505
2990DATA 1A1A301A1A301A1A
3000DATA 0F0F300F0F300F0F
3010DATA 2525302525302525
3020DATA 0A0A200A0A200A0A
3030REM VAN )
3040DATA 3C3838383838383C
3050DATA 3C3030303030303C
3060DATA 3C3030303030303C
3070DATA 3C3C3C3C3C3C3C3C
3080DATA 3C2828282828283C
3090DATA 283C141414143C28
3100REM CAR (
3110DATA 1133333333333311
3120DATA 3333222222223333
3130DATA 3322333333332233
3140DATA 3300333333330033
3150DATA 3311333333331133
3160DATA 2233111111113322
3170REM NORMAL TURTLE )
3180DATA E5E3E2E2E2E2E3E5
3190DATA F3C0C0C0C0C0C0F3
3200DATA F2C0C0C0C0C0C0F2
3210DATA D8D3D1C4C4D1D3D8
3220REM NORMAL TURTLE (
3230DATA E7E3E2C0C0E2E3E7
3240DATA F1C0C0C0C0C0C0F1
3250DATA F3C0C0C0C0C0C0F3
3260DATA DAD3D1D1D1D1D3DA
3270REM DIVING TURTLE )
3280DATA E5253C3C3C3C25E5
3290DATA 303C3C3C3C3C3C30
3300DATA 703C3C3C3C3C3C70
3310DATA 9A1A303333301A9A
3320REM Read in sprite data
3330CX=&D00
3340REM read data for log
3350?LB=CX:?HB=CX/256
3360LB?1=CX:HB?1=CX/256
3370LB?6=CX:HB?6=CX/256
3380PROCR(15,48)
3390REM read data for crocodile
3400LB?2=CX:HB?2=CX/256
```

John Wilson, his BBC micro and a frog provide hints on road safety.

Table 1.

Bit number	7	6	5	4	3	2	1	0
Left pixel	B3		B2		B1		B0	
Right pixel		B3		B2		B1		B0



Program 1. Description.

Lines	Use
80 to 130	Data for title
140	Select teletext mode
150 to 390	Display title using teletext graphics
400 to 450	The frog sounds its presence
480	Reset page to a higher value ready for the next part
490	Load and run the next part

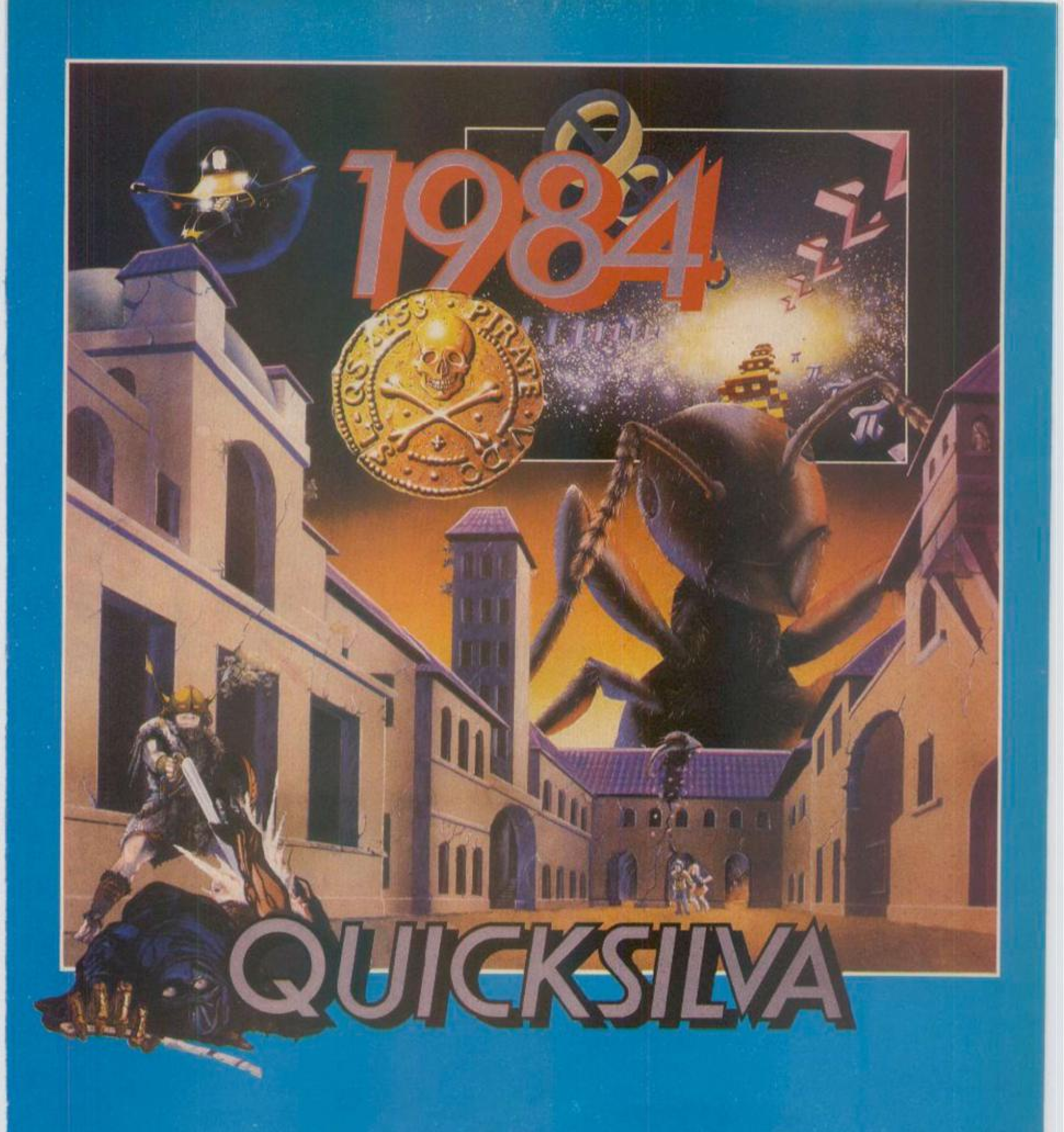
your family unawares. Move your frogs across one at a time avoiding the ever-increasing traffic and river populated by many crocodile and turtles.

Avoid the holes occupied by the hungry crocodiles. If you do not you will be invited to dinner! You collect points for getting a frog safely to its hole and bonus points for getting the whole family home. You can collect more points by jumping on any flies that appear, but make sure you are not caught by the snake. As the game progresses, more traffic takes to the road and more crocodiles populate the river.

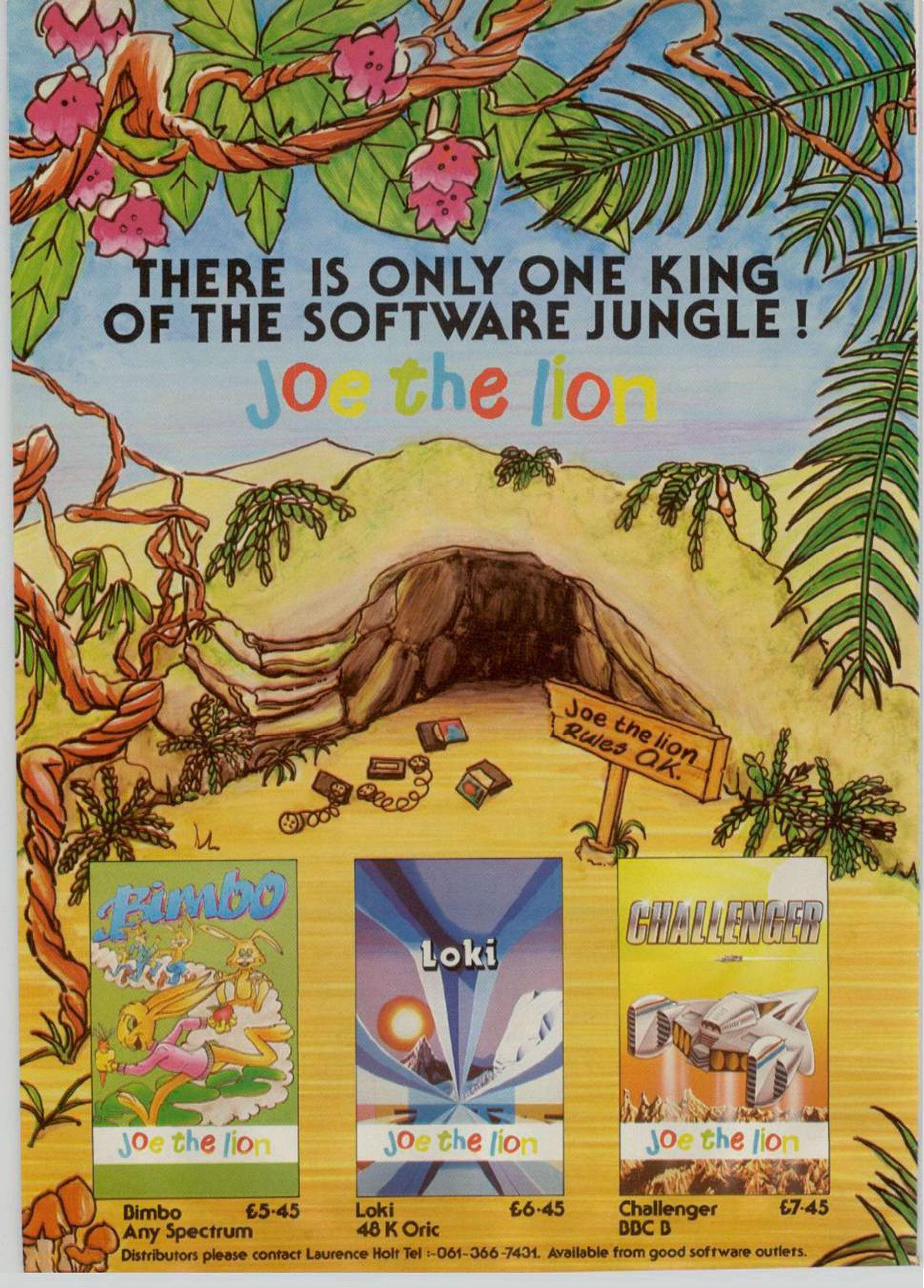
Your family has one final enemy — the dreaded French Chef who will cut your legs off if you take too long. Therefore, keep an eye on your time. Once you reach the fourth phase, you are awarded a bonus frog to keep your family company. To move your frog, use the following controls: Z — Left; X — Right; : — Up; / — Down. Or, alternatively, you may define your own keys.

To fit this program into the limited memory

(continued on page 91)



...THE YEAR OF THE GAME LORDS.


THERE IS ONLY ONE KING
OF THE SOFTWARE JUNGLE!
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(continued from page 87)
required some special program design and splitting the whole game into three separate programs. The first program is a short title page, which loads the remaining programs higher up in memory. The second program assembles the machine code, creates the graphics characters and prints the instructions.

Although the game uses machine code, it should be possible to modify the program, or even convert it to another computer with a little work. To help anyone attempting this conversion, I give a brief description of what the main parts of each program do.

Anyone who has attempted to directly access the screen memory in the high resolution graphics modes would have encountered a problem. In mode 2, each byte of screen memory holds the colours for two adjacent pixels, and is stored in a rather strange way. The logical colour numbers are split up into binary and stored in separate bits — see table

For example, a red pixel next to a green pixel would be stored as follows:

Logical colour red = 1 = 0001 in binary.
Logical colour green = 2 = 0010 in binary.
memory byte = 0 0 0 1
0 0 1 0
= 0 0 0 0 0 1 1 0 = decimal 6

The next problem encountered is the order in which the bytes are stored. Eight consecutive bytes of screen memory store the colour information for 16 pxiels in a block two wide and eight deep. The next eight consecutive bytes of screen memory is a similar block of pixels adjacent to the previous block.

To make the graphics quicker and to get round the above problems, the simple machine code program is used. All this program does is to Poke consecutive bytes of screen memory, in order to make up a character. Another machine code program uses the Poke subroutine to delete, move and re-print all the graphics for the logs, cars, etc. This program is virtually instantaneous, allowing for high speed arcade-type action. Another machine code program tests for whether the frog has been hit by a car, or fallen into the water.

This program works by testing each pixel next to the frog and counting the pixels that have logical colours less than eight, excluding black. As all the dangerous obstacles of the program are made up from colours in the range 1 to 7, it is easy to tell whether the frog has strayed onto something it should not have. Also, all the safe obstacles, such as the logs, swimming turtles and the crocodiles back, are defined using colours in the range 8 to 15.

The machine code is assembled into pages &900 and &A00, which are normally unused by the computer for most of the time. All the

(continued on next page)

Program 2. Description

Lines	Use
170	Stop the program, if page is not set
190 to 210	Define sound envelopes
240 to 550	Define user characters
560 to 590	Display title
610 to 1120	Assemble machine code to move graphics
1160 to 1730	Assemble machine code to 'Poke' graphics
1770 to 2180	Assemble machine code to 'Peek' at frogs position
2200 to 2280	Set up all 'labels' required by assembler
2310 to 2340	Find the position of each line of screen memory for the machine code
2370 to 2520	Data for log graphics
2540 to 2680	Data for crocodile graphics
2700 to 2790	Data for lorry graphics
2810 to 2860	Data for 'sports car' graphics
2880 to 2930	Data for motorbike graphics
2950 to 3020	Data for tractor graphics
3040 to 3090	Data for van graphics
3110 to 3160	Data for car graphics
3180 to 3210	Data for turtle moving right graphics
3230 to 3260	Data for turtle moving left graphics
3280 to 3310	Data for diving turtle graphics
3320 to 3890	Read in and decode graphics data
3910 to 3940	Read in data about graphics
3960 to 3990	Data about graphics length, speed and direction
4010 to 4020	Set flash rates of colours 8 to 15
4040 to 4060	Ask if instructions are required
4070 to 4080	Display instructions, if required
4140	Load and run the last program
4190 to 4270	Read in, decode and store a line of graphics data
4310 to 4340	Print in double height writing
4380 to 4420	Press the space bar to continue
4460 to 4960	Print instructions
5000 to 5200	Display title page
5220 to 5270	Set up text window

Listing 3.

```
[illegible]
```

(continued from previous page)

data required by the machine code is then stored into memory from page &D00 to page &1100. The program finally loads the last and final part of the game, after printing the instructions.

The listings are long and will take plenty of time and energy to type in. If you feel you do not have either the stamina or patience for such an epic, I will supply the game on cassette. Send £3 to John Wilson, 336 High Road, Benfleet, Essex SS7 5HP. ■

Program 3. Description.

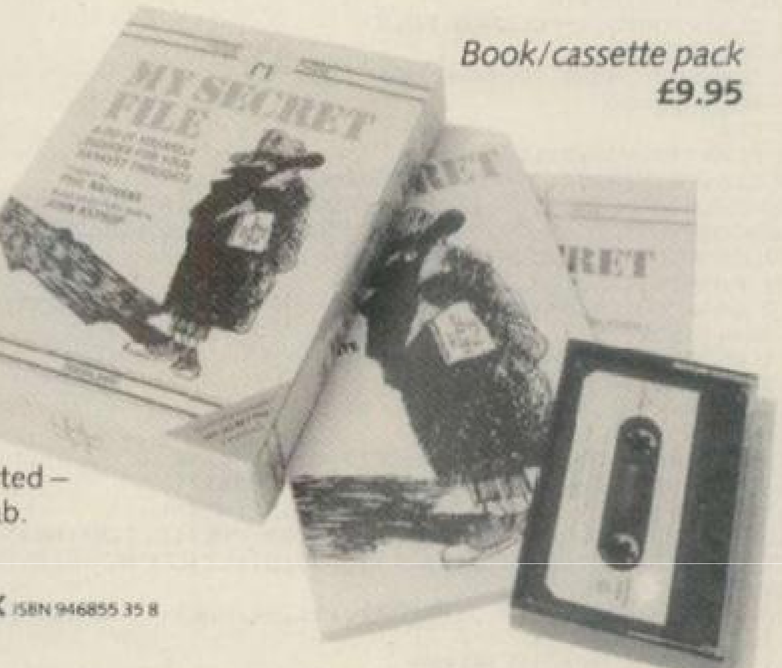
Lines	Use
60	Make sure Page has been set correctly
70	Reset variables for keys
80	Trap any errors
90	Turn off the auto-repeat on keys
100 to 120	Display title
130 to 170	Choose whether sound is required
180 to 210	Choose whether to change the controls
200	Clear variables ready for the next game
230 to 240	Set up variables for speed and direction of drift on river
250 to 270	Set up variables required to use machine code
280	Select 16 colour graphics mode
290	Make cursor invisible
300	Set up main variables for the game
320	Update timer and move objects
330 to 400	Move your frog
410	Test for whether frog has got home
420 to 500	Update fly
510 to 600	Update crocodile in hole
610 to 650	Move snake
660	Print screen
670 to 690	Make colours disappear
710 to 720	Print hedge at top of screen
730 to 770	Put holes in hedge
780 to 790	Print river
800 to 810	Print grass
820	Print hedge at bottom of screen
830 to 850	Print writing
860 to 870	Reset timer
880 to 910	Print any frogs left alive
920	Update score
930 to 950	Reset positions of objects
1030	Read the number of objects on this screen
1040 to 1160	Read in data for object positions
1170 to 1190	Reset position of frog
1210 to 1250	Print phase number
1260 to 1310	Redefine colours to display screen
1330	Gain a bonus frog
1350 to 1410	Sound the beginning of the phase
1420 to 1460	Delete phase number
1470 to 1500	Reset flags to show that the holes are empty
1520	Delete a frog
1530 to 1580	Set up variables for fly, crocodile and snake
1590	Start clock
1610 to 1640	Time delay
1650	Update score
1660	Plot frog
1670 to 1680	Update timer
1690 to 1710	Your family has been caught by the Chef
1720 to 1910	Your frog has safely reached a hole
1920	Are all the holes full?
1930	Reset position of frog
1970 to 2090	Your frog has died
2150	Continue to play, if there are any more frogs left alive
2160 to 2170	Display your final socre
2180	Update high score, if necessary
2190	Print high score
2200 to 2250	Play another game, if required
2260 to 2290	Print in double height writing
2300 to 2350	Collect bonus points for eating the fly
2360	Print the snake
2370	Trap escape key (If the Shift is not pressed.)
2380	Reset repeat rate on keys
2390 to 2410	Print error message
2420 to 2540	Data for phase 0
2550 to 2670	Data for phase 1
2680 to 2800	Data for phase 2
2810 to 2930	Data for phase 3
2940 to 3060	Data for phase 4
3070 to 3190	Data for phase 5
3200 to 3350	Gain bonus points for completing a screen
3370 to 3400	Move traffic
3410	Go on to the next phase
3430 to 3460	Define control keys
3470 to 3500	Define left key
3510 to 3550	Define right key
3560 to 3600	Define up key
3610 to 3650	Define down key
3660 to 3680	Press the Space Bar to start

MOSAIC MOSAIC

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Available for the: **Spectrum 48K** ISBN 946855 15 3 **BBC Micro B** ISBN 946855 20 X

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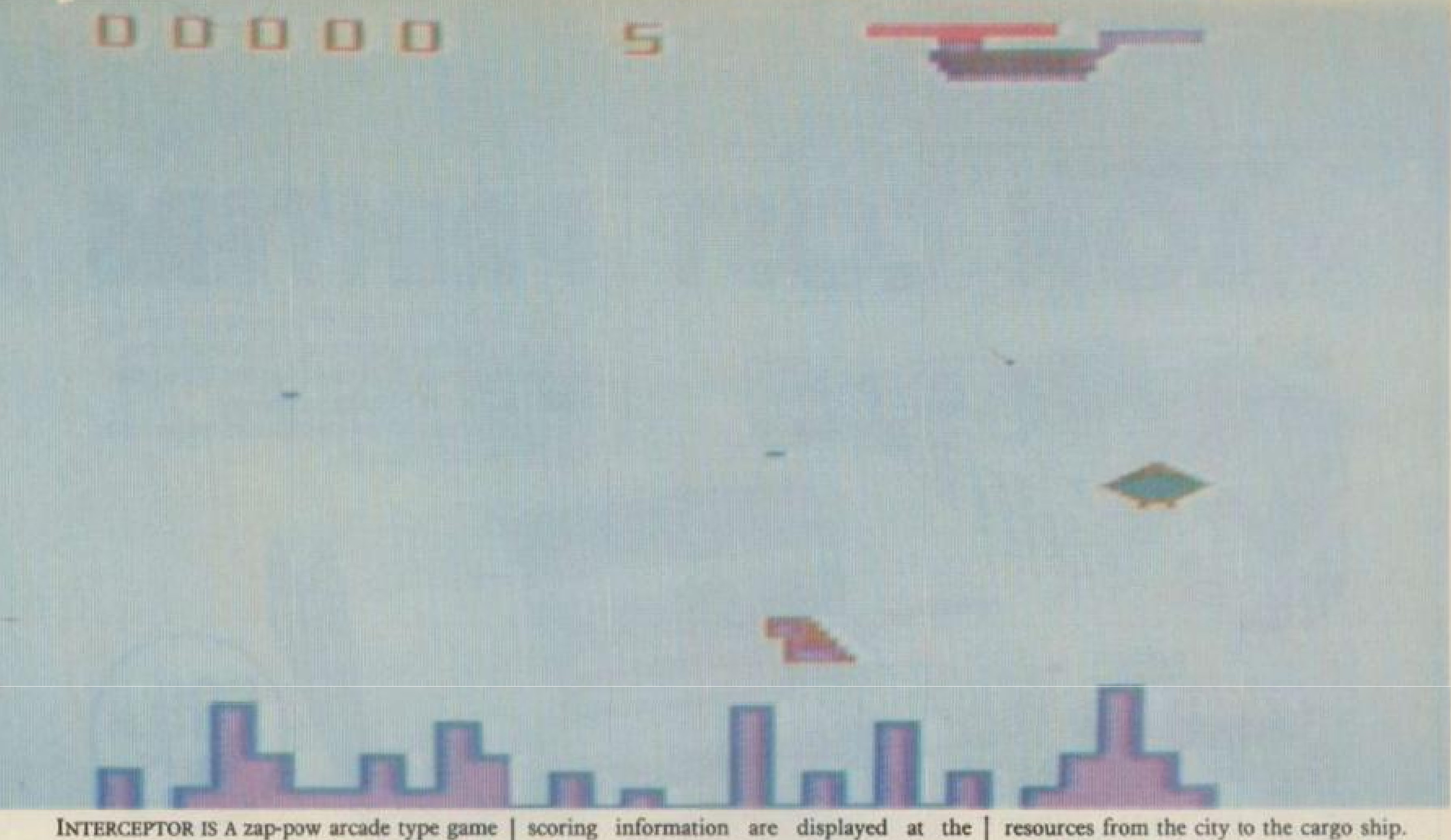
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BOOKWARE

DRAGON INTERCEPTOR

Stop the aliens stealing resources from your city in V Parkin's smooth action game.

```
1 CLEAR200,27979
6 GOSUB10000
7 DIMH(4):DIMN$(4)
10 CLS:PMODE3,1:PCLEAR8:PCLS
20 GOSUB20100
22 CLS:PRINT@234,"PLEASE WAIT"
25 GOSUB21000
30 CLS
90 PLAY"T9;V30;O1;L1EL2F"
95 CLS:PRINT@233,"THEY'RE COMING"
100 PCLS:DRAW"S16;C6;BM0,180;R2U2R2D2R2U1R2D1R4U6R2D6R
2U2R2D2R2U5R2D5R2U2R2D3R2U2R2U2R2U4R2D4R2D2R2D2R4U3R2D
3R2U2R2U3U2R2D3R2D2R4U2R2D2R2U4R2D2R2"
101 PAINT(1,188),7,6
110 DRAW"S8;C7;BM166,0;R20D1L20NU1R8D2R4NU2L4R17U2R10D
1L8G4L14H2E1"
111 DRAW"S0;C7;BM166,1;R20"
112 PAINT(218,4),7,7
113 PAINT(186,4),7,7
114 PAINT(186,8),7,7
115 FORI=180TO216 STEP2:PSET(I,6,6):NEXTI
116 FORI=182TO212 STEP2:PSET(I,8,6):NEXTI
117 FORI=184TO214 STEP2:PSET(I,10,6):NEXTI
118 FORI=166TO206 STEP2:PSET(I,0,8):PSET(I,2,8):NEXTI
119 FORI=1TO950:NEXTI:PLAY"T9;V30;O1;L2;EFF#F":CLS:PRI
NT@237,"NEARER'
200 FORI=0TO254 STEP 2:PSET(I,191,6):PSET(I,189,6):PSE
T(I,187,6):NEXT I
201 PLAY"T9;V30;O1;L1EL2F"
202 CLS:PRINT@235,"RED ALERT":FORI=1TO750:NEXTI
203 PLAY"T9;V5;O1;L4EP16FP16F#P16FP16V10EP16FP16F#P16F
P16V15EP16FP16F#P16FP16V20EP16FP16F#P16FP16V25EP16FP16
F#P16FP16V30EP16FP16F#P16F"
210 PCOPY 1 TO 5:PCOPY 2 TO 6:PCOPY 3 TO 7:PCOPY 4 TO
8
300 FORI=32250TO32320:POKE I,0:NEXT I
310 POKE32250,0:POKE32251,0
320 POKE32258,5
330 POKE32228,0:POKE32229,4:POKE32230,96:POKE32231,106
340 POKE32220,0:POKE32221,4:POKE32222,96:POKE32223,106
350 POKE32248,&H7D:POKE32249,&H1E
360 DEFUSR0=&H6E1B
370 A=USR0(&H6E1B)
380 POKE32220,27:POKE32221,31:POKE32222,14:POKE32223,3
0
390 POKE32232,27:POKE32233,31:POKE32234,14:POKE32235,3
0
400 POKE32248,&H7C:POKE32249,&H8B
410 A=USR0(&H6E1B)
420 POKE32236,27:POKE32237,31:POKE32238,14:POKE32239,3
0
430 POKE32244,27:POKE32245,31:POKE32246,14:POKE32247,3
0
440 POKE32252,0:POKE32253,0
450 POKE32232,0:POKE32233,4:POKE32234,96:POKE32235,106
460 POKE32240,0:POKE32241,4:POKE32242,96:POKE32243,106
470 POKE32308,1:POKE32309,31
475 PCOPY 5 TO 1:PCOPY 6 TO 2:PCOPY 7 TO 3:PCOPY 8 TO
4:SCREEN 1,1
480 TIMER=RND(255)
490 DEFUSR0=&H733C
500 A=USR0(&H733C)
510 FORI=1TO1000:NEXTI
520 SC=PEEK(32291)+PEEK(32292)*10+PEEK(32293)*100+PEEK
(32294)*1000+PEEK(32295)*10000
540 GOSUB20000
550 CLS:PRINT@11,"YOUR SCORE=";SC
560 PRINT:PRINT"HIGH SCORES="
570 FORI=1TO4:PRINTTAB(0)H(I);TAB(8)N$(I):NEXTI
9997 PRINT@457,"PRESS SPACEBAR"
9998 IF INKEY$<>" "THEN9998
9999 GOSUB20100:GOTO300
10000 CLS:PRINT@203,"INTERCEPTOR":PRINT@299,"BY V PARK
IN"
10010 FOR I=1 TO 1000:NEXT
10020 CLS:PRINT"  ALIEN INVADERS ARE STEALING","YOUR C
ITY'S VALUABLE RESOURCES."
10021 PRINT"YOU HAVE AT YOUR DISPOSAL FIVE","INTERCEPT
OR FIGHTERS (5 LIVES)","TO PROTECT THE CITY BY BLOWING
"
10022 PRINT"UP THE ALIEN SHUTTLES."
10023 PRINT"  YOU WILL GAIN 10 POINTS FOR","EACH DESCE
NDING CRAFT DESTROYED"
10024 PRINT"BUT ONLY 5 POINTS IF YOU DESTROYAN ASCENDI
NG CRAFT.YOU WILL","LOSE 5 POINTS EACH TIME THE","ALIE
N CRAFT BEAMS RESOURCES TO  THE HOVERING CARGO SHIP."
10025 PRINT@457,"PRESS SPACEBAR"
10030 IF INKEY$<>" "THEN10030
10031 CLS:PRINT"  THE CARGO SHIP IS OUT OF RANGEOF YOU
R INTERCEPTORS."
10032 PRINT"  OCCASIONALLY A FORMATION OF","FLYING NEU
TRON BOMBS WILL APPEAR(WHICH KILL PEOPLE,BUT LEAVE","B
UILDINGS ETC. UNHARMED.)"
10033 PRINT"  IF YOU CAN SHOOT THEM DOWN","YOU WILL GA
IN 50 POINTS EACH.","IF YOU FAIL, EACH ONE LANDING   D
EDUCTS 50 POINTS FROM YOUR","SCORE.";
10034 PRINT" IF YOU COLLIDE WITH A',"NEUTRON BOMB YOU
LOSE A LIFE,  BUT THE BOMB MIGHT NOT ALWAYS","BE DEST
ROYED."
10035 PRINT@457,"PRESS SPACEBAR"
10040 IF INKEY$<>" "THEN10040
10041 CLS:PRINT"  BEWARE OF TINY SPACEMINES","LEFT ABO
UT THE SCREEN OR YOU    MAY LOSE AN INTERCEPTOR."
10042 PRINT:PRINT:PRINT:PRINT:PRINT"  GOOD LUCK WITH Y
OUR MISSION"
10043 PRINT@457,"PRESS SPACEBAR"
10050 IF INKEY$<>" "THEN 10050
10060 RETURN
20000 FORI=1TO4
20010 IF SC>H(I)THEN HI=I:GOTO20040
20020 NEXT I
20030 RETURN
20040 FOR I=4 TO HI STEP-1
20050 H(I)=H(I-1):N$(I)=N$(I-1)
20060 NEXT I
20070 H(HI)=SC:N$(HI)=N$
20080 RETURN
20100 CLS:PRINT"PLEASE ENTER YOUR NAME"
20110 INPUT N$
20120 FOR I=1TO1000:NEXTI
20130 RETURN
21000 FORI=&H6D4C TO &H76A5
21010 READ A:POKE I,A:NEXT
21011 DATA189,109,120,16,142,124,236,252,125,224,195,6
,0,31,1,246,125,220,166,133,167,160,92,241,125,221,38,
246,189
21012 DATA109,164,38,230,57,189,109,120,16,142,125,80,
126,109,83,182,125,223,198,32,61,195,0,32,253,125,226,
182
21013 DATA125,222,198,32,61,253,125,224,57,182,125,231
,198,32,61,195,0,32,253,125,226,182,125,230,198,32,61,
253
21014 DATA125,224,57,252,125,224,195,0,32,253,125,224,
16,179,125,226,57,189,109,142,16,190,125,248,252,125,2
24,195
21015 DATA6,0,31,1,246,125,228,166,133,39,3,189,112,16
4,170,160,167,133,92,241,125,229,38,239,189,109,164,38
,223
21016 DATA57,189,114,173,18,252,125,234,253,125,242,18
2,1,91,129,22,37,5,129,42,34,22,57,182,125,234,129,18,
37
21017 DATA13,128,3,183,125,234,182,125,235,128,3,183,1
25,235,57,182,125,234,129,133,34,248,139,3,183,125,234
,182
```



INTERCEPTOR IS A zap-pow arcade type game with smooth movement and good colour. All the action of the game is controlled by the machine-code routine. You need one joystick in the right-hand port.

The scenario and playing instructions and scoring information are displayed at the beginning of the game. You have five interceptor fighters — one at a time — to protect the city by shooting and destroying the alien shuttles. These shuttles go up and down on the right hand-side of the screen, taking resources from the city to the cargo ship.

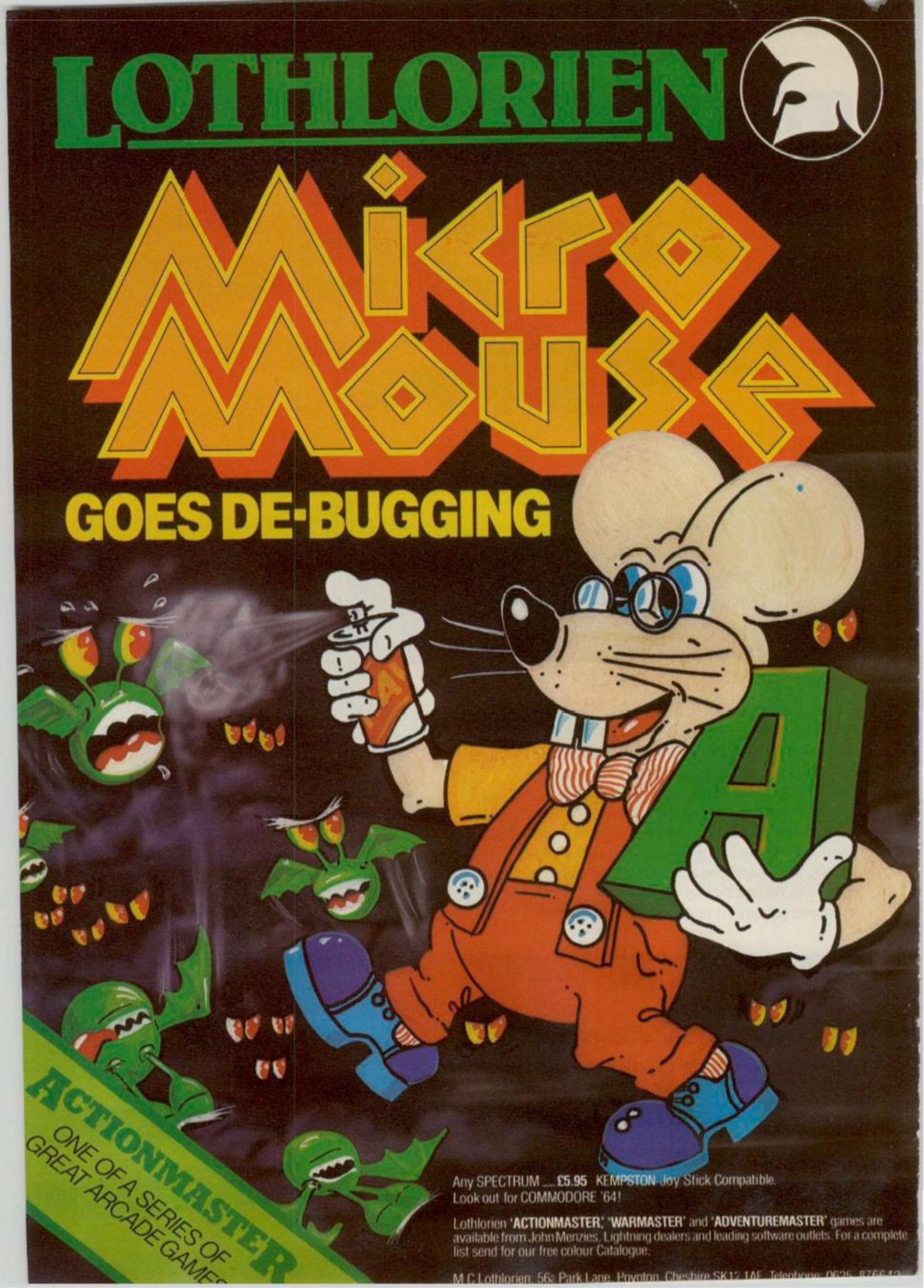
Scoring is simple: 10 points for each descending alien destroyed, five points for each ascending alien destoryed, and each time an alien returns to the cargo ship and beams

(continued on page 99)

```
21018 DATA125,235,139,3,183,125,235,57,189,109,142,16,
190,125,248,252,125,224,195,6,0,31,1,246,125,228,166,1
33,167
21019 DATA160,92,241,125,229,38,246,189,109,164,38,230
,57,189,109,120,16,190,125,248,252,125,224,195,6,0,31,
1
21020 DATA246,125,220,166,160,164,133,167,133,92,241,1
25,221,38,244,189,109,164,38,228,57,182,125,252,39,9,1
22,125
21021 DATA252,189,113,42,126,110,175,182,125,253,38,24
,252,125,238,253,125,246,139,1,203,1,253,125,238,193,1
44,37
21022 DATA42,124,125,253,189,113,37,57,252,125,238,253
,125,246,128,1,192,1,253,125,238,129,12,34,18,122,125,
253,252
21023 DATA125,250,124,125,251,198,5,247,125,250,189,11
3,34,57,182,125,234,187,1,19,132,15,129,8,38,3,126,111
21024 DATA86,57,198,180,247,255,215,215,140,198,1,189,
186,160,247,255,214,57,246,125,254,38,29,246,255,0,193
,126,39
21025 DATA5,193,254,39,1,57,189,114,247,18,18,252,125,
226,195,5,192,253,125,255,189,110,191,246,125,254,190,
125
21026 DATA255,111,133,92,247,125,254,189,111,20,246,12
5,254,193,31,36,9,193,0,39,4,134,15,167,133,57,127,125
,254
21027 DATA57,166,133,38,1,57,241,125,236,37,45,241,125
,237,34,40,182,125,238,198,32,61,195,6,0,16,179,125,25
5
21028 DATA34,25,195,1,192,16,179,125,255,37,16,124,126
,3,198,10,247,125,250,189,112,49,134,0,126,111,229,189
,115
21029 DATA247,18,18,18,18,18,126,112,121,206,126,4,195
,0,225,196,39,9,51,67,17,131,126,31,35,244,57,182,125,
236
21030 DATA128,1,167,192,182,125,238,198,32,61,195,7,0,
237,196,57,206,126,4,198,0,225,196,38,9,51,67,17,131,1
26
21031DATA 31,35,242,57,230,192,174,196,134,0,167,133,90,
 231,194,189,111,172,230,196,39,223,134,80,167,133,51
,67
21032 DATA17,131,126,31,35,211,57,166,133,38,1,57,241,
125,232,37,59,241,125,233,34,54,182,125,234,190,32,61,
195
21033 DATA6,0,191,125,224,16,179,125,224,34,36,195,1,6
4,16,179,125,224,37,27,126,114,159,125,126,2,39,3,122,
126
21034 DATA2,134,0,167,196,246,125,254,183,125,254,190,
125,255,167,133,57,189,111,249,230,196,126,111,225,198
,0
21035 DATA247,125,250,189,112,49,57,254,126,44,16,190,
126,40,142,124,36,166,192,161,132,39,4,48,8,32,248,198
,7,48
21036 DATA1,166,128,167,164,49,168,32,90,38,246,49,169
,255,32,49,62,16,188,126,42,36,217,57,246,125,250,192,
10
21037 DATA37,9,141,10,198,1,142,126,36,32,6,246,125,25
0,142,126,35,166,132,52,4,171,224,128,10,45,13,167,128
21038 DATA140,126,39,39,14,166,132,198,1,32,235,166,13
2,52,4,171,224,167,132,57,182,126,34,38,9,139,0,183,12
6,34
21039 DATA189,111,123,57,122,126,34,57,206,126,4,38,14
,17,131,126,31,39,31,51,67,109,196,38,2,32,242,18,18,1
8
21040 DATA18,51,65,172,196,39,4,51,66,32,228,51,95,111
,192,127,125,254,111,133,57,126,114,148,17,131,124,236
,38
21041 DATA18,125,126,1,38,46,124,126,1,125,126,2,39,38
,122,126,2,32,33,125,126,3,38,28,52,4,52,2,52,16,52
21042 DATA32,52,64,198,10,189,112,49,53,64,53,32,53,16
,53,2,53,4,124,126,3,57,246,125,250,190,126,38,38,22,1
90
21043 DATA126,36,38,17,182,126,35,52,4,160,224,43,4,18
3,126,35,57,127,126,35,57,206,126,35,166,196,52,4,160
21044 DATA224,43,3,167,196,57,166,196,139,10,52,4,160,
224,167,192,17,131,126,39,39,4,198,1,32,225,57,189,112
,225
21045 DATA134,10,183,125,252,182,125,251,38,58,182,125
,239,198,32,61,195,6,32,31,1,16,142,0,10,246,125,236,2
03
21046 DATA1,134,40,167,133,48,136,64,49,63,16,140,0,0,
38,243,182,125,252,129,1,38,15,127,125,252,134,0,48,13
7
21047 DATA253,128,16,142,0,10,32,221,57,182,125,238,19
8,32,61,195,5,225,31,1,246,125,236,134,32,167,133,48,1
36
21048 DATA224,134,128,167,133,48,136,224,192,1,134,2,1
67,133,48,136,224,134,8,167,133,182,125,252,129,1,38,2
7,127
21049 DATA125,252,127,125,251,134,0,167,133,48,136,32,
167,133,48,136,32,203,1,167,133,48,136,32,167,133,57,2
52
21050 DATA125,236,253,125,228,252,125,238,253,125,230,
252,125,244,253,125,220,252,125,246,253,125,222,204,12
4,136,253
21051 DATA125,248,57,252,125,232,253,125,228,252,125,2
34,253,125,230,252,125,240,253,125,220,252,125,242,253
,125,222
21052 DATA204,125,30,253,125,248,57,79,142,126,4,230,1
32,167,128,16,174,129,167,165,140,126,34,37,242,57,134
,0
21053 DATA183,125,232,183,125,232,134,4,183,125,233,18
```

(listing continued on page 99)


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1 CLEAR 24299
GO SUB 3500
3051 LET r=9: GO SUB 3500
3052 PRINT AT 10,17;"


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(continued from page 95)

up resources you lose five points. If your interceptor is hit by an alien bullet you lose a life. Occasionally waves of neutron bombs will appear in formation. You score 50 points for each one you destroy, and lose 50 for each one which lands on the city. If you collide with a neutron bomb you lose a life but the bombs may not always be destroyed. Beware of tiny space mines accidentally left about the screen.

A personalised high score list is kept of the top four scores and on-screen scoring is an additional feature.

Top left is score and top centre is lives left. A primitive but effective colour mixing system is used at lines 115 to 118 to gain extra colours on the high resolution screen. This is achieved by alternating lines of different colours. A better system would use a cross-hatch pattern but this needs to be Poked into screen memory as the plot function of the Dragon is not accurate enough to set individual pixels in PMode 3.

All the Basic does is to set up the graphics, display instructions, and keep and display the table of high scores.

The main program is entirely in machine code. The machine code was originally written using the Tandy Edtasm Plus Assembler but was converted to decimal code and placed in data statements, from which the machine code is now Poked in from Basic. This is to avoid having special machine code loaders. If anyone has this assembler he can type it in from the assembler listing to the addresses shown and Saved separately, and the subroutine starting at 21000 to end, and line 25 can be omitted.

If the machine code has been Saved separately as above, line 25 could be used to load the machine-code routine with

CLOADM"NAME"

The machine code routine is not relocatable.

(listing continued from page 95)

```
3,125,233,134,96,183,125,234,183,125,234,134,106,183,1
25,235,183
21054 DATA125,235,127,126,1,246,125,254,190,125,255,11
1,133,127,125,254,189,110,27,57,134,27,183,125,236,183
,125
21055 DATA236,134,31,183,125,237,183,125,237,134,14,18
3,125,238,183,125,238,134,30,183,125,239,183,125,239,1
27,126
21056 DATA3,189,110,27,57,189,109,120,252,125,226,131,
0,128,253,125,226,16,142,6,32,252,125,224,195,6,0,31,1
,246
21057 DATA125,220,166,160,167,133,92,241,125,221,38,24
6,189,109,164,38,230,57,252,125,230,253,125,222,189,11
4,237
21058 DATA57,109,164,39,6,254,125,248,126,112,167,57,1
25,126,1,38,6,124,126,1,126,111,217,126,111,225,173,15
9,160
21059 DATA10,252,125,232,253,125,240,182,126,47,39,4,1
22,126,47,57,134,2,183,126,47,182,1,90,129,22,37,5,129
21060 DATA42,34,15,57,182,125,232,129,4,35,20,122,125,
232,122,125,233,57,182,125,232,129,18,36,6,124,125,232
,124
21061 DATA125,233,57,252,125,228,253,125,220,189,110,6
1,57,246,125,233,247,125,254,57,182,126,48,39,4,122,12
6,48
21062 DATA57,182,125,252,38,250,134,5,183,126,48,16,14
2,24,95,142,24,96,198,0,166,133,183,126,49,92,193,32,3
9,6
21063 DATA166,133,167,165,32,245,182,126,49,167,165,48
,136,32,49,168,32,16,140,29,31,37,221,57,125,126,2,38,
1
21064 DATA57,189,109,219,189,113,212,189,110,61,189,11
0,27,204,124,236,253,125,248,189,109,178,189,110,207,1
89,112
21065 DATA103,189,110,97,189,113,181,189,110,61,189,11
0,27,204,125,80,253,125,248,189,109,178,204,126,35,253
,126,44
21066 DATA204,6,8,253,126,40,204,6,0,253,126,42,189,11
2,2,204,126,2,253,126,44,204,6,14,253,126,40,253,126,4
2
21067 DATA189,112,2,125,125,252,38,82,125,126,1,39,33,
134,5,183,126,46,189,113,212,189,114,138,189,114,95,19
8,1
21068 DATA189,110,193,189,114,138,122,126,46,38,240,18
9,113,243,189,114,6,125,126,3,39,39,134,5,183,126,46,1
89,113
21069 DATA181,189,114,138,189,114,95,198,100,189,110,1
93,189,114,138,122,126,46,38,240,189,114,56,182,1,18,1
29
21070 DATA2,16,34,1,181,18,189,114,254,22,255,69,52,11
8,206,126,54,225,192,38,89,16,174,193,16,191,125,224,1
88,125
21071 DATA224,39,38,49,168,32,16,191,125,224,188,125,2
24,39,26,49,168,32,16,191,125,224,188,125,224,39,14,49
21072 DATA168,32,16,191,125,224,188,125,224,16,38,0,41
,51,93,134,5,183,126,50,198,10,247,125,250,189,112,49,
122
21073 DATA126,50,38,243,127,125,254,127,125,255,127,12
6,0,31,50,189,117,119,53,118,109,225,57,51,66,17,131,1
26,63
21074 DATA37,155,53,118,57,16,142,126,54,230,160,174,1
61,39,18,79,167,133,48,136,32,167,133,48,136,32,167,13
3,48
21075 DATA136,32,167,133,16,140,126,62,37,226,16,142,1
26,54,230,160,174,164,16,39,1,14,23,0,254,18,140,24,0,
37
21076 DATA15,134,10,189,118,149,95,142,0,0,175,164,231
,162,32,75,175,164,125,126,51,39,5,122,126,51,32,12,13
4
21077 DATA1,183,126,51,90,193,0,38,2,198,31,231,162,16
6,133,39,2,141,70,134,10,167,133,48,136,32,166,133,39,
2
21078 DATA141,57,134,240,167,133,48,136,32,166,133,39,
2,141,44,134,240,167,133,48,136,32,166,133,39,2,141,31
,134
21079 DATA10,167,133,49,35,16,140,126,63,37,141,125,12
6,50,39,13,198,5,247,125,250,189,112,225,122,126,50,38
,238
21080 DATA57,241,125,232,37,57,241,125,233,34,52,182,1
25,234,198,32,61,195,6,0,191,125,224,16,179,125,224,34
,34
21081 DATA195,1,64,16,179,125,224,37,25,125,126,1,38,1
3,134,1,183,126,1,125,126,2,39,3,122,126,2,141,46,109
21082 DATA225,22,255,167,166,133,129,15,38,34,134,5,18
3,126,50,198,10,247,125,250,189,112,49,122,126,50,38,2
43,127
21083 DATA125,254,127,125,255,127,126,0,141,6,109,225,
22,255,127,57,230,160,174,160,111,164,111,162,111,162,
111
21084 DATA133,48,136,32,111,133,48,136,32,111,133,48,1
36,32,126,118,133,125,126,52,39,4,48,136,32,57,48,136,
224
21085 DATA57,49,63,22,255,80,134,31,183,126,54,142,11,
32,191,126,55,134,26,183,126,57,142,13,32,191,126,58,1
34
21086 DATA31,183,126,60,142,15,32,191,126,61,127,125,2
52,189,109,219,189,113,212,189,110,61,189,110,27,204,1
24,236
21087 DATA253,125,248,189,109,178,189,110,207,189,112,
103,189,116,100,204,126,35,253,126,44,204,6,8,253,126,
40,204
21088 DATA6,0,253,126,42,189,112,2,204,126,2,253,126,4
4,204,6,14,253,126,40,253,126,42,189,112,2,189,114,254
,125
21089 DATA126,1,39,39,134,5,183,126,46,189,113,212,189
,114,138,189,114,95,198,1,189,110,193,189,114,138,122,
126
21090 DATA46,38,240,189,113,243,189,114,6,125,126,2,38
,1,57,16,142,126,55,16,140,126,63,44,56,109,160,38,7,1
09
21091 DATA161,38,3,32,240,57,142,1,244,48,31,140,0,0,3
8,249,141,3,22,255,104,122,126,53,34,13,125,126,52,39
21092 DATA9,127,126,52,134,25,183,126,53,57,134,1,183,
126,52,134,31,183,126,53,57,127,1,18,126,115,60,111,13
3
21093 DATA52,118,198,200,215,140,198,1,189,186,160,53,
118,57,183,126,50,52,118,198,0,215,140,198,8,189,186,1
60,53,118,57
22000 FOR I=32080 TO 32199:POKE I,0:NEXT
30000 PCLS
30010 DRAW"S8;C8;BM0,0;R4D3NR3U3F5L7U3L2U3"
30020 PAINT(3,3),7,8
30030 PAINT(12,5),8,8
30040 POKE32220,0:POKE32221,4:POKE32222,0:POKE32223,10
30050 DEF USR0=&H6D4C
30060 A=USR0(&H6D4C)
30070 PCLS:DRAW"S4;C8;BM0,8;R1E1R1E1R1E1R2E1R2NU1R1NU1
R2F1R2F1R1F1R1F1R1L1G1L1G1L1G1L2G1NF1L5NG1H1L2H1L1H1L1
H1"
30080 PAINT(12,8),6,8
30090 POKE32220,0:POKE32221,4:POKE32222,0:POKE32223,14
30100 DEFUSR0=&H6D6E
30110 A=USR0(&H6D6E)
30120 FORI=31780TO31859
30130 READ A:POKE I,A
30140 NEXT
30141 DATA0,255,195,195,195,195,195,255
30142 DATA1,48,48,48,48,48,48,48
30143 DATA2,255,3,3,255,192,192,255
30144 DATA3,255,3,3,255,3,3,255
30145 DATA4,195,195,195,255,3,3,3
30146 DATA5,255,192,192,255,3,3,255
30147 DATA6,192,192,192,255,195,195,255
30148 DATA7,255,3,3,3,3,3,3
30149 DATA8,255,195,195,255,195,195,255
30150 DATA9,255,195,195,255,3,3,3
30160 RETURN
```

■

Program 2.

```
0 REM FOR "■" READ CTRL + KEY 3
10 GOTO30000
100 POKE36877,245
110 B=INT(PN/256)
120 POKE0,PN-B*256:POKE1,B
130 SYS6445
140 IFA=11THENPN=PN-1:GOTO155
150 PN=PN+1
155 B=INT(PN/256)
156 POKE0,PN-B*256:POKE1,B
160 SYS6625
170 IFPEEK(2)<>255THEN320
180 GOSUB1800
190 IFLF$=""THEN20000
200 LF$=LEFT$(LF$,LEN(LF$)-2):POKE36878,8
210 PN=4545
230 PRINT"■■■■CRS   SCORE   LIFE"
240 PRINT"■■■"PS
250 PRINT"■■■■■■■■■"SC
260 PRINT"■■■■■■■■■■■■■■■■■■"LF$
290 IFSG=1THENGOSUB2000
300 IFSG=2THENGOSUB3000
310 GOSUB4000
320 B=INT(PN/256)
330 POKE0,PN-B*256:POKE1,B:POKE2,10
340 IFA=11THENSYS6593:RETURN
350 SYS6609:RETURN
400 POKEP1,32
410 P1=P1+22
420 IFP1>4293THEN490
430 IFD1=1THEN450
440 IFPEEK(P1+1)=32ANDRND(1)>0.8THENP1=P1+1:GOTO0460
450 IFPEEK(P1-1)=32ANDRND(1)>0.8THENP1=P1-1
460 POKEP1,109
470 POKEP1+CO,C1-8
480 RETURN
490 IFPEEK(P1+1)<>32THENP1=P1-1
500 B=INT(P1/256)
510 POKE0,P1-B*256:POKE1,B:POKE2,C1
520 SYS6497
530 S1=2
540 RETURN
600 B=INT(P1/256)
610 POKE0,P1-B*256:POKE1,B
620 SYS6561
630 P1=P1+22
640 IFP1>4425THEN720
650 IFD1=1THEN670
660 IFPEEK(P1+2)=32ANDRND(1)>0.8THENP1=P1+1:GOTO0680
670 IFPEEK(P1-1)=32ANDRND(1)>0.8THENP1=P1-1
680 B=INT(P1/256)
690 POKE0,P1-B*256:POKE1,B:POKE2,C1
700 SYS6497
710 RETURN
720 IFPEEK(P1+2)<>32THENP1=P1-1
730 B=INT(P1/256)
740 POKE0,P1-B*256:POKE1,B:POKE2,C1
750 SYS6429
760 S1=3
770 RETURN
800 B=INT(P1/256)
810 POKE0,P1-B*256:POKE1,B
820 SYS6445
830 P1=P1+44
840 IFP1>4557THEN920
850 IFD1=1THEN870
860 IFPEEK(P1+3)=32ANDRND(1)>0.8THENP1=P1+1:GOTO0880
870 IFPEEK(P1-1)=32ANDRND(1)>0.8THENP1=P1-1
880 B=INT(P1/256)
890 POKE0,P1-B*256:POKE1,B:POKE2,C1
900 SYS6429
910 RETURN
920 PS=PS+1:SC=SC+10:CS=CS+1
930 PRINT"■■■"PS:PRINT"■■■■■■■■■"SC
940 C1=9
950 IFRND(1)>0.7THENC1=11
960 IFRND(1)>0.7THENC1=15
970 P1=4216
980 IFRND(1)>0.5THENP1=4217
990 D1=0
1000 IFRND(1)>0.5THEND1=1
1010 S1=1
1020 RETURN
1100 POKEP2,32
1110 P2=P2+22
1120 IFP2>4293THEN1190
1130 IFD2=1THEN1150
1140 IFPEEK(P2+1)=32ANDRND(1)>0.8THENP2=P2+1:
     GOTO1160
1150 IFPEEK(P2-1)=32ANDRND(1)>0.8THENP2=P2-1
1160 POKEP2,109
```

(continued on opposite page)

VI

COMPETE IN a short, cross-country style race — a little like the arcade game Turbo. You start off on a road leading to a city. By overtaking four cars the driving scene changes to the countryside on the outskirts of the city and a mountain range appears in the distance. By overtaking another four cars you will arrive back at the start line ready for another lap.

The program comes in two parts; program 1 must always be loaded and run before loading program 2 — the actual game. It is advisable to save both parts before running.

To help you with the Data statements the program goes through them in three separate sections and performs a check after each.

The following notes will help you type in some of the lines. The brackets should not be typed: they show you in what form the characters should be typed in, e.g., the line:
PRINT "(CSR HOME)(SHIFT VUA)(3 SPACES) (COMMODORE NSR)"
means type the Cursor Home key, then type the characters VUA with Shift held down, then type three spaces, and finally type the characters NSR with the Commodore key held down. Note: spaces must be typed without shift unless (SHIFT SPACE) is written.

```
2000 POKE 646,9
2010 PRINT "(CSR HOME)(2 CSR DOWNS)
     (SHIFT VUV)(2 SPACES)(SHIFT SSTU)
     (SPACE)(SHIFT SST)(SPACE)(SHIFT
     UV)(SPACE)(SHIFT SSTUU)";
2020 PRINT "(SHIFT WWWWWWSSWWWWSS
     WWWWWWSSWWW)";
2030 PRINT "(SHIFT WWWWWWSSWWWWSS
     WWWWWWSSWWW)"
3010 PRINT "(CSR HOME)(2 CSR DOWNS)
     (19 SPACES)(SHIFT XYZ)";
3020 PRINT "(15 SPACES)(SHIFT +)
     (COMMODORE -)(SHIFT ↑)
     (COMMODORE *)(SHIFT SPACE)
     (COMMODORE K)";
3030 PRINT "(13 SPACES)(COMMODORE
     IT@G+M£)(SHIFT £)(COMMODORE N)"
4000 PRINT "(CSR HOME)(CSR RED)(5 CSR
     DOWNS)(8 CSR RIGHTS) (SHIFT
     FC)(2SPACES)(SHIFT *P)"
4010 PRINT "(8 CSR RIGHTS)(SHIFT GD)(2
     SPACES) (SHIFT AQ)"
4020 PRINT "(8 CSR RIGHTS)(SHIFT HE)
     (2SPACES)(SHIFT BR)"
4030 PRINT "(7 CSR RIGHTS)(SHIFT IC)
     (4 SPACES)(SHIFT *M)"
4040 PRINT "(7CSR RIGHTS)(SHIFT JD)
     (4 SPACES)(SHIFT AN)"
4050 PRINT "(6 CSR RIGHTS)(SHIFT FKE)
     (4 SPACES)(SHIFT BOP)"
4060 PRINT "(6 CSR RIGHTS)(SHIFT GC)
     (6 SPACES)(SHIFT *Q)"
4070 PRINT "(6 CSR RIGHTS)(SHIFT HD)
     (6 SPACES)(SHIFT AR)"
4080 PRINT "(5 CSR RIGHTS)(SHIFT ILE)
     (6 SPACES)(SHIFT BLM)"
4090 PRINT "(5 CSR RIGHTS)(SHIFT JC)
     (8 SPACES) (SHIFT *N)"
4100 PRINT "(4 CSR RIGHTS)(SHIFT FKD)
     (8 SPACES)(SHIFT AOP)"
4110 PRINT "(4 CSR RIGHTS)(SHIFT GLE)
```

(continued on page 104)

Program 1.

```
10 POKE36879,8
20 PRINT"■■■■■■■■■CHEQUERED FLAG"
30 PRINT"■■■■■==============="
40 PRINT"■■*** BY NEIL KIRK ***"
50 PRINT"■■■■■■■-(C) 1983-"
60 PRINT"■■■■■LOAD AND RUN THIS"
70 PRINT"■PROGRAM BEFORE PLAYING"
80 PRINT"+++ CHEQUERED FLAG +++"
90 PRINT"■■■■■■■■■HIT A KEY!"
100 POKE198,0
110 GETA$:IFA$=""THEN110
120 PRINT"■■■■■■■NOW LOAD.."
130 POKE36878,15
140 FORF=1TO12
150 POKE36874,F*10+120
160 PRINT"■■■■■CHEQUERED FLAG"
170 FORE=1TO100
180 NEXTE,F
190 POKE642,26:POKE641,53
200 SYS64824
```

C RALLY 20

For Vic-20 owners with 16K and the urge to live life in the fast lane. Neil Kirk hands you the wheel.

(continued from opposite page)

```
1170 POKEP2+CO,C2-8
1180 RETURN
1190 IFPEEK(P2+1)<>32THENP2=P2-1
1200 B=INT(P2/256)
1210 POKE0,P2-B*256:POKE1,B:POKE2,C2
1220 SYS6497
1230 S2=2
1240 RETURN
1300 B=INT(P2/256)
1310 POKE0,P2-B*256:POKE1,B
1320 SYS6561
1330 P2=P2+22
1340 IFP2>4425THEN1420
1350 IFD2=1THEN1370
1360 IFPEEK(P2+2)=32ANDRND(1)>0.8THENP2=P2+1:GOTO1380
1370 IFPEEK(P2-1)=32ANDRND(1)>0.8THENP2=P2-1
1380 B=INT(P2/256)
1390 POKE0,P2-B*256:POKE1,B:POKE2,C2
1400 SYS6497
1410 RETURN
```

(listing continued on page 104)

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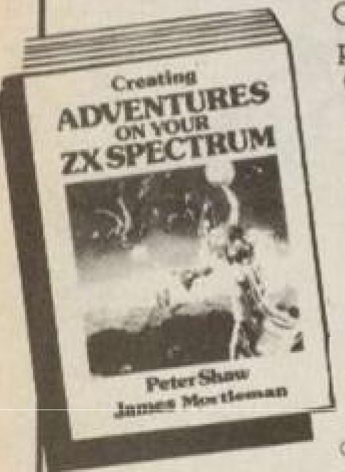
(continued from page 101)

```
      (8 SPACES)(SHIFT BLQ)"
4120 PRINT "(4 CSR RGHTS)(SHIFT HC)
      (10 SPACES)(SHIFT *R)"
4130 PRINT "(3 CSR RGHTS)(SHIFT ILD)
      (10 SPACES)(SHIFT ALM)"
4140 PRINT "(3 CSR RGHTS)(SHIFT JLE)
      (10 SPACES)(SHIFT BLN)"
4150 PRINT "(2 CSR RGHTS)(SHIFT FKC)
      (12 SPACES)(SHIFT *OP)"
4160 PRINT "(2 CSR RGHTS)(SHIFT GLD)
      (12 SPACES)(SHIFT ALG)"
4170 PRINT "(2 CSR RGHTS)(SHIFT HLE)
      (12 SPACES)(SHIFT BLR)";
```

(listing continued from page 101)

```
1420 IFPEEK(P2+2)<>32THENP2=P2-1
1430 B=INT(P2/256)
1440 POKE0,P2-B*256:POKE1,B:POKE2,C2
1450 SYS6429
1460 S2=3
1470 RETURN
1500 B=INT(P2/256)
1510 POKE0,P2-B*256:POKE1,B
1520 SYS6445
1530 P2=P2+44
1540 IFP2>4557THEN1620
1550 IFD2=1THEN1570
1560 IFPEEK(P2+3)=32ANDRND(1)>0.8THENP2=P2+1:GOTO1580
1570 IFPEEK(P2-1)=32ANDRND(1)>0.8THENP2=P2-1
1580 B=INT(P2/256)
1590 POKE0,P2-B*256:POKE1,B:POKE2,C2
1600 SYS6429
1610 RETURN
1620 PS=PS+1:SC=SC+10:CS=CS+1
1630 PRINT"■■■"PS:PRINT"■■■■■■■■■"SC
1640 C2=9
1650 IFRND(1)>0.7THENC2=11
1660 IFRND(1)>0.7THENC2=15
1670 P2=4216
1680 IFRND(1)>0.5THENP2=4217
1690 D2=0
1700 IFRND(1)>0.5THEND2=1
1710 S2=1
1720 RETURN
1800 B=INT(PN/256)
1810 POKE0,PN-B*256:POKE1,B
1820 SYS6445
1830 POKE36874,0:POKE36877,100:POKE36878,15
1840 POKEPN+23,141:POKEPN+23+CO,2
1850 FORF=1TO400:NEXT
1860 POKEPN,142:POKEPN+CO,10
1870 POKEPN+1,143:POKEPN+1+CO,10
1880 POKEPN+2,144:POKEPN+2+CO,10
1890 POKEPN+22,145:POKEPN+22+CO,10
1900 POKEPN+23,146:POKEPN+23+CO,10
1910 POKEPN+24,147:POKEPN+24+CO,10
1920 POKEPN+44,148:POKEPN+44+CO,10
1930 POKEPN+45,149:POKEPN+45+CO,10
1940 POKEPN+46,150:POKEPN+46+CO,10
1950 POKE36877,220
1960 FORL=15TO0STEP-1:POKE36878,L
1970 FORM=1TO100:NEXTM,L
1980 POKE36877,150:POKE36878,0
1990 FL=1:GOTO15000
2000 POKE646,9
2010 PRINT"■■■ /K  ** , **I  /K **I /";
2020 PRINT"OOOOO**OOO**OOOOO**OOO";
2030 PRINT"OOOOO**OOO**OOOOO**OOO"
2040 RETURN
3000 POKE646,9
3010 PRINT"■■■                    * *";
3020 PRINT"                    +I I ";
3030 PRINT"                 ■ J ■ ■ ";
3040 RETURN
4000 PRINT"■■■■■■■■■■■■■■■■L-  -"
4010 PRINT"■■■■■■■■■I"  *■"
4020 PRINT"■■■■■■■■■I"  L"
4030 PRINT"■■■■■■■■-"   -\"
4040 PRINT"■■■■■■■■"-   ■/"
4050 PRINT"■■■■■■■/"    I"
4060 PRINT"■■■■■■■-"    -■"
4070 PRINT"■■■■■■■I"    ■"
4080 PRINT"■■■■■■L"     IL\"
4090 PRINT"■■■■■■-"     -/"
4100 PRINT"■■■■■/"      ■"
4110 PRINT"■■■■■L"      IL■"
4120 PRINT"■■■■I"       -/"
4130 PRINT"■■■■L"       ■L\"
4140 PRINT"■■■L"        IL/"
4150 PRINT"■■/"         -"
4160 PRINT"■■L"         ■L■"
4170 PRINT"■■L"         IL";
4180 RETURN
6000 A=PEEK(197)
6010 IFA=11ORA=12THENGOSUB100:GOTO6050
6020 POKE36877,150:B=INT(PN/256)
6030 POKE0,PN-B*256:POKE1,B:POKE2,10
6040 SYS6429
6050 ONS1GOSUB400,600,800
6060 IFN<>0THENN=N-1:GOTO6080
6070 ONS2GOSUB1100,1300,1500
6080 B=INT(PN/256)
6081 POKE0,PN-B*256:POKE1,B
6082 SYS6625
6090 IFPEEK(2)<>255THEN6300
6100 GOSUB1800
6110 IFLF$=""THEN20000
6120 LF$=LEFT$(LF$,LEN(LF$)-2):POKE36878,0
6130 PN=4545
6150 PRINT"■■■CRS   SCORE   LIFE"
6160 PRINT"■■■"PS
6170 PRINT"■■■■■■■■■■"SC
6180 PRINT"■■■■■■■■■■■■■■■■■■■■"LF$
6210 IFSO=1THENGOSUB2000
6220 IFSO=2THENGOSUB3000
6230 GOSUB4000
6300 IFCS<CRTHEN6000
6310 SO=SO+1:CS=0
6320 IFSO=2THENGOSUB3000:GOTO6000
6330 CR=CR+2:SC=SC+100
6340 GOTO14000
10000 POKE36879,8:POKE198,0
10010 PRINT"■■■■■■■■■■■■** BY NEIL KIRK ***"
10020 PRINT"■■■■■■■"(C) 1983-"
10030 PRINT"■■-----------------------*"
10040 PRINT"■■                     *"
10050 PRINT"■■ HIGH SCORE"HS;TAB(20)"*"
10060 PRINT"■■                     *"
10070 PRINT"■■-----------------------*"
10080 PRINT"■■■■LAST SCORE"SC
10090 PRINT"■■■■■■'Y' TO START"
10100 PRINT"■■■'I' INSTRUCTIONS"
10110 PRINT"■■■■ANY KEY TO END";
10120 SC=0:FL=0
10130 PS=0
10140 CR=4
10150 CS=0
10160 P1$="■■■■■"
10170 P2$="■■■■■"
10180 FORF=1TO7
10190 FORG=0TO6
10200 PRINT"■";MID$(P1$,F,1);LEFT$(P2$,G);"■■■■
      CHEQUERED FLAG"
10210 GETA$:IFA$<>""THEN10240
10220 NEXTG,F
10230 GOTO10180
10240 IFA$="Y"THEN15000
10250 IFA$="I"THEN12000
10260 POKE36879,27
10270 POKE36869,192
10280 POKE650,0
10290 PRINT"■BYE-BYE!";CHR$(9)
10300 END
12000 POKE36879,42
12010 PRINT"■■■■■■■■CHEQUERED FLAG"
12020 PRINT"■■■■---------------"
12030 PRINT"■THIS IS A DRIVING GAME";
12040 PRINT"■WHERE YOU MUST SCORE"
12050 PRINT"■AS MANY POINTS AS"
12060 PRINT"■POSSIBLE BY OVERTAKING";
12070 PRINT"■CARS. EACH CAR SCORES"
12080 PRINT"■10 POINTS."
12085 GETA$:IFA$=""THEN12085
12110 PRINT"■BY PASSING A CERTAIN"
12120 PRINT"■NUMBER OF CARS (4) THE";
12130 PRINT"■DRIVING SCENE CHANGES.";
12140 PRINT"■AFTER THE SECOND SCENE";
12150 PRINT"■YOU WILL ARRIVE BACK"
12160 PRINT"■AT THE START LINE."
12170 PRINT"■YOU RECEIVE 100 BONUS"
12180 PRINT"■POINTS AND GET YOUR"
12190 PRINT"■3 LIVES BACK."
12200 PRINT"■■■■■■■■HIT A KEY!■■"
12210 GETA$:IFA$=""THEN12210
12230 PRINT"THE GAME NOW BECOMES"
12240 PRINT"■MORE DIFFICULT AS YOU"
12250 PRINT"■HAVE TO PASS MORE CARS";
12260 PRINT"■TO MOVE ONTO THE NEXT"
12270 PRINT"■SCENE. (2 EXTRA CARS"
12275 PRINT"■PER EXTENDED PLAY)"
12280 PRINT"■THE GAME ENDS WHEN"
12290 PRINT"■YOU HAVE CRASHED THREE";
12300 PRINT"■TIMES AND LOST ALL OF"
12310 PRINT"■YOUR LIVES."
12315 PRINT"■■■■■■■■HIT A KEY!";
12316 GETA$:IFA$=""THEN12316
12317 PRINT
12320 PRINT"THE TOP OF THE SCREEN"
12330 PRINT"■SHOWS "
12340 PRINT"■CARS YOU HAVE PASSED"
12350 PRINT"■YOUR PRESENT SCORE"
12370 PRINT"■YOUR REMAINING LIVES"
12380 PRINT"■■CONTROLS "
12390 PRINT"■'Y'      LEFT"
12400 PRINT"■'I'      RIGHT"
12410 PRINT"■■■■■■■■HIT A KEY!■■"
12420 GETA$:IFA$=""THEN12420
12430 GOTO10000
14000 PRINT"■ ( 44 SPACES )"
14010 POKE36877,0:POKE36874,0:POKE36878,15
14020 FORF=1TO16
14030 PRINT"■■■■■■EXTENDED  PLAY"
14040 POKE36876,240
14050 FORE=1TO50:NEXTE
14060 PRINT"■                    "
14070 POKE36876,0
14080 FORE=1TO50:NEXTE,F
14090 FL=0
15000 PN=4545
15010 S1=1:S2=1
15020 P1=4216:IFRND(1)>0.5THENP1=4217
15030 P2=4216:IFRND(1)>0.5THENP2=4217
15040 D1=0:IFRND(1)>0.5THEND1=1
15050 D2=0:IFRND(1)>0.5THEND2=1
15060 C1=9:IFRND(1)>0.7THENC1=11
15070 IFRND(1)>0.7THENC1=15
15080 C2=9:IFRND(1)>0.7THENC2=11
15085 IFRND(1)>0.7THENC2=15
15090 N=6
15100 IFFL=1THENPOKE36874,210:RETURN
15110 SO=1:LF$="* * "
15120 POKE36879,91
15130 POKE36878,15
15140 PRINT"■■■■■CHEQUERED FLAG"
15150 PRINT"■■■■---------------"
15160 PRINT"■■■■PREPARE TO START"
15170 GOSUB4000
15180 PRINT"■■■■■■■■■■■■■■■LLLLLL";:POKE646,9:
      PRINT"...■LLLLLL"
15190 FORF=1TO6:PRINT"■■■■■■■■■■■■■■■■■■■":NEXTF
15200 POKE0,193:POKE1,17:POKE2,10:SYS6429
15210 POKE38161,10:GOSUB16000
15220 POKE38161,9
15230 POKE38162,11:GOSUB16000
15240 POKE38162,9
15250 POKE38163,15:GOSUB16000
15260 POKE38163,9
15270 POKE38164,13
15280 POKE36877,245
15290 FORF=1TO350:NEXTF
15300 PRINT"■■■■CRS   SCORE   LIFE"
15310 PRINT"■■■"PS
15320 PRINT"■■■■■■■■■■"SC
15330 PRINT"■■■■■■■■■■■■■■■■■■■■"LF$
15360 GOSUB2000
15370 GOSUB4000
15380 POKE36877,150:POKE36874,210:POKE36878,8
15390 GOTO6000
16000 POKE36875,230
16010 FORF=1TO250:NEXTF
16020 POKE36875,0
16030 FORF=1TO350:NEXTF
16040 RETURN
20000 POKE36877,0:POKE36874,0:PRINT"■
 "
20010 PRINT"■■■■■■■■";
20020 B$="GAME..OVER"
20030 FORF=1TO10
20040 PRINTMID$(B$,F,1);
20050 FORL=15TO0STEP-1
20060 POKE36878,L
20070 POKE36874,L*2+210
20080 POKE36875,L*2+210
20090 POKE36876,L*2+210
20100 NEXTL,F
20110 POKE36878,15
20120 PRINT
20130 PRINT"■■■■■■■■-----------"
20140 POKE36874,220
20150 POKE36875,220
20160 POKE36876,220
20170 FORF=1TO700:NEXTF
20180 POKE36874,0
20190 POKE36875,0
20200 POKE36876,0
20210 POKE36878,0
20220 IFHS<SCTHENHS=SC
20230 GOTO10000
30000 POKE36879,25
30010 PRINT"■■■■■■■■■■■■CHEQUERED FLAG"
30020 PRINT"■■■■---------------"
30030 PRINT"■■■■SETTING UP CHARACTERS!"
30040 PRINT"■■■■PLEASE WAIT..."
30050 FORF=5120TO5631
30060 POKEF,PEEK(F+27648)
30070 NEXTF
30080 AM=0
30090 FORF=5632TO5991
30100 READA
30110 POKEF,A:AM=AM+A
30120 NEXTF
30130 IFAM<>51265THENPRINT"DATA ERROR. LINES...",
      "40000-40440":GOTO31000
30140 AM=0
30150 FORF=5992TO6327
30160 READA
30170 POKEF,A:AM=AM+A
30180 NEXTF
30190 IFAM<>34444THENPRINT"DATA ERROR. LINES...",
      "40450-40860":GOTO31000
30200 AM=0
30210 FORF=6328TO6703
30220 READA
30230 POKEF,A:AM=AM+A
30240 NEXTF
30250 IFAM<>42460THENPRINT"DATA ERROR. LINES...",
      "40870-41220":GOTO31000
30260 HS=0
30270 CO=33792
30280 POKE36878,0
30290 POKE36869,205
30300 POKE650,128
30310 PRINTCHR$(8)
30320 GOTO10000
31000 POKE36879,27
31010 PRINT"■BYE-BYE!";CHR$(9)
31020 END
40000 DATA255,255,255,127,127,127,63,63
40010 DATA63,31,31,31,15,15,15,7
40020 DATA7,7,3,3,3,1,1,1
40030 DATA255,255,255,254,254,254,252,252
40040 DATA252,248,248,248,240,248,248,224
40050 DATA224,224,192,192,192,128,128,128
40060 DATA0,0,0,0,1,1,1,3
40070 DATA3,7,7,7,15,15,31,31
40080 DATA31,63,63,127,127,127,255,255
40090 DATA1,1,1,3,3,7,7,7
40100 DATA15,15,31,31,31,63,63,127
40110 DATA127,127,255,255,255,255,255,255
40120 DATA255,255,255,255,255,255,255,255
40130 DATA128,128,128,192,192,224,224,224
40140 DATA240,240,248,248,248,252,252,254
40150 DATA254,254,255,255,255,255,255,255
40160 DATA0,0,0,0,128,128,128,192
40170 DATA192,224,224,224,240,240,240,240
40180 DATA240,252,252,254,254,254,255,255
40190 DATA170,170,187,187,170,170,187,187
40200 DATA128,128,128,128,138,138,138,138
40210 DATA42,42,38,38,38,38,38,38
40220 DATA0,0,0,0,170,170,170,170
40230 DATA170,170,170,170,170,170,170,170
40240 DATA0,0,0,2,10,10,42,42
40250 DATA0,0,170,170,190,175,171,170
40260 DATA0,0,128,160,168,250,254,191
40270 DATA0,0,0,0,2,10,42,42
40280 DATA0,0,0,10,170,169,165,149
40290 DATA0,0,0,170,170,85,86,90
40300 DATA0,2,10,170,170,171,175,255
40310 DATA170,171,175,191,254,250,250,234
40320 DATA170,174,175,175,171,171,171,170
40330 DATA191,175,171,234,250,250,254,254
40340 DATA0,0,0,2,10,10,42,171
40350 DATA0,10,170,171,175,191,255,255
40360 DATA174,190,254,254,250,250,234,234
40370 DATA149,85,90,170,170,175,191,255
40380 DATA106,171,175,191,255,254,254,250
40390 DATA255,255,255,234,170,169,169,165
40400 DATA234,170,169,165,149,85,85,85
40410 DATA170,106,90,90,86,86,85,85
40420 DATA255,255,191,191,191,175,175,111
40430 DATA255,195,165,153,153,165,195,129
40440 DATA255,255,235,235,235,235,255,255
40450 DATA24,219,255,219,24,219,255,219
40460 DATA2,62,62,62,62,2,10,0
40470 DATA128,188,188,188,188,128,160,32
40480 DATA40,32,34,242,250,207,243,240
40490 DATA40,0,136,143,175,243,207,15
40500 DATA0,62,63,48,63,63,63,0
40510 DATA40,40,170,170,170,170,170,170
40520 DATA0,252,252,12,252,252,252,0
40530 DATA0,2,2,10,10,40,40,42
40540 DATA170,170,170,0,0,0,40,170
40550 DATA0,128,128,160,160,40,40,40
40560 DATA252,252,254,194,195,252,252,252
40570 DATA170,170,170,170,255,255,60,0
40580 DATA63,63,131,131,195,63,63,63
40590 DATA48,60,63,51,60,63,15,3
40600 DATA40,40,170,170,170,170,170,170
40610 DATA0,0,192,240,60,204,252,252
40620 DATA0,2,2,10,10,40,232,248
40630 DATA170,170,170,0,0,0,40,170
40640 DATA62,140,128,160,160,40,56,60
40650 DATA252,252,206,194,243,252,60,12
40660 DATA170,170,170,170,255,255,60,0
40670 DATA63,15,131,179,255,63,15,3
40680 DATA0,0,3,15,60,51,63,63
40690 DATA40,40,170,170,170,170,170,170
40700 DATA12,60,252,204,60,252,240,192
40710 DATA60,50,2,10,10,40,44,60
40720 DATA170,170,170,0,0,0,40,170
40730 DATA0,128,128,160,160,40,43,47
40740 DATA252,240,194,206,255,252,240,192
40750 DATA170,170,170,170,255,255,60,0
40760 DATA63,63,179,131,207,63,60,48
40770 DATA2,60,36,24,30,12,10,17
40780 DATA3,0,0,0,0,0,48,12
40790 DATA0,192,128,128,128,128,32,47
40800 DATA0,3,12,48,32,32,188,128
40810 DATA0,0,2,2,0,0,3,12
40820 DATA42,42,170,170,170,170,238,34
40830 DATA160,160,128,128,132,48,15,0
40840 DATA0,0,0,0,0,3,0,0
40850 DATA128,128,128,128,192,0,0,0
40860 DATA128,128,192,48,12,0,0,0
40870 DATA160,0,165,0,133,87,24,165,1,105,132,133
40880 DATA88,138,145,0,165,2,145,87,232,200,138,145
40890 DATA0,165,2,145,87,232,200,138,145,0,165,2
40900 DATA145,87,232,24,152,105,20,168,138,145,0,165
40910 DATA2,145,87,232,200,138,145,0,165,2,145,87
40920 DATA232,200,138,145,0,165,2,145,87,232,24,152
40930 DATA105,20,168,138,145,0,165,2,145,87,232,200
40940 DATA138,145,0,165,2,145,87,232,200,138,145,0
40950 DATA165,2,145,87,96
40960 DATA72,138,72,152,72,162,114,32,104,24,104,168
40970 DATA104,170,104,96
40980 DATA72,138,72,152,72,162,32,160,0,138,145,0
40990 DATA200,145,0,200,145,0,24,152,105,20,168,138
41000 DATA145,0,200,145,0,200,145,0,24,152,105,20
41010 DATA168,138,145,0,200,145,0,200,145,0,104,168
41020 DATA104,170,104,96
41030 DATA72,138,72,152,72,162,110,160,0,165,0,133
41040 DATA87,24,165,1,105,132,133,88,138,145,0,165
41050 DATA2,145,87,232,200,138,145,0,165,2,145,87
41060 DATA232,24,152,105,21,168,138,145,0,165,2,145
41070 DATA87,232,200,138,145,2,165,2,145,87,104,168
41080 DATA104,170,104,96
41090 DATA72,138,72,152,72,162,32,160,0,138,145,0
41100 DATA200,145,0,24,152,105,21,168,138,145,0,200
41110 DATA145,0,104,168,104,170,104,96
41120 DATA72,138,72,152,72,162,132,32,104,24,104,168
41130 DATA104,170,104,96
41140 DATA72,138,72,152,72,162,123,32,104,24,104,168
41150 DATA104,170,104,96
41160 DATA72,138,72,152,72,162,255,160,0,132,2,177
41170 DATA0,201,32,240,14,201,114,240,10,201,123,240
41180 DATA6,201,132,240,2,134,2,200,177,0,201,32
41190 DATA240,14,201,115,240,10,201,124,240,6,201,133
41200 DATA240,2,134,2,200,177,0,201,32,240,14,201
41210 DATA116,240,10,201,125,240,6,201,134,240,2,134
41220 DATA2,104,168,104,170,104,96
```

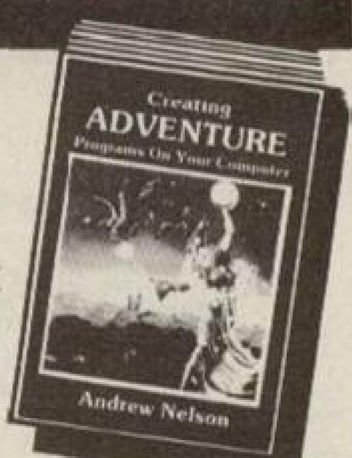
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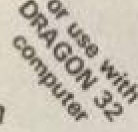
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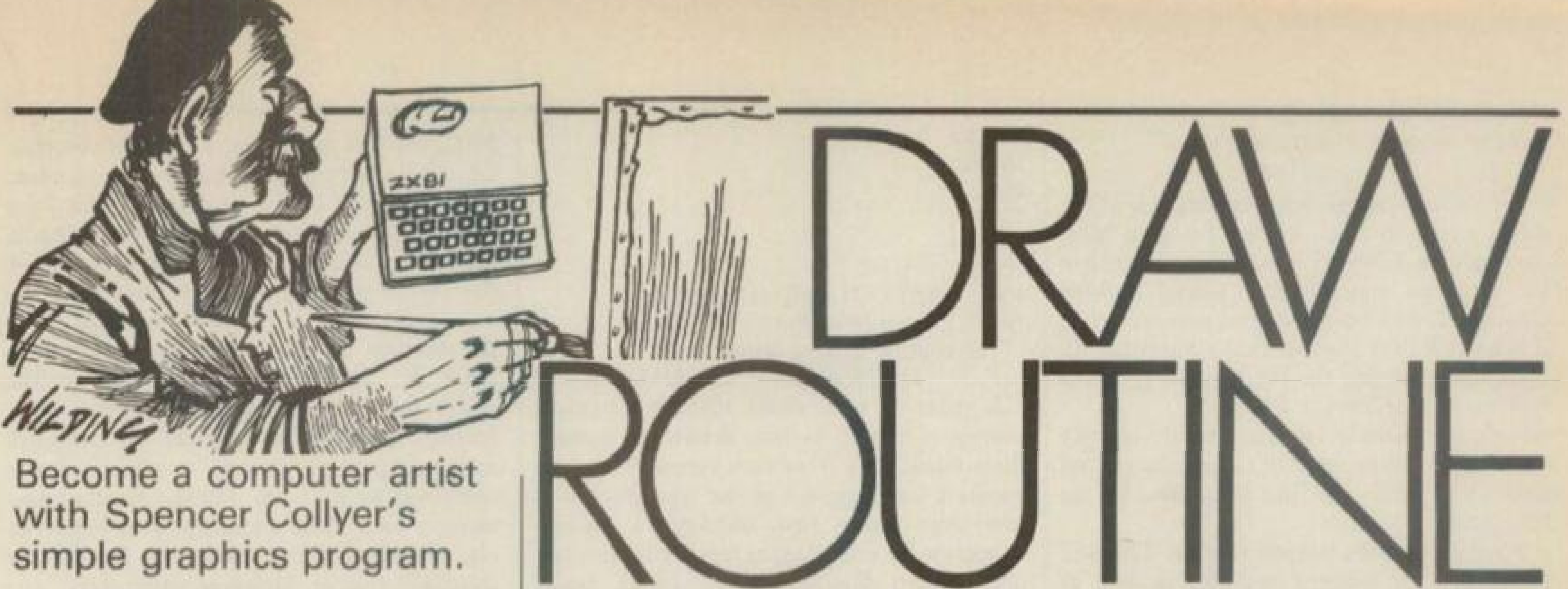
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DRAW ROUTINE

Become a computer artist with Spencer Collyer's simple graphics program.

ZXDRAW IS A SET OF three graphics utilities for the ZX-81, allowing the user to draw straight liens, circles, and triangles. All three can Plot or Unplot the shapes onto the screen, and both circles and triangles may be filled or unfilled.

To enter ZXDRAW, create the first three Rem statements with lengths:

REM1 365 bytes
REM 2 453 bytes
REM 3 185 bytes

The enter the hexloader for Froggie — page 82 in this issue — and input the three machine-code blocks set out in tables 1, 2 and 3, with the starting addresses as shown.

Thirdly, enter the Sin-table creation program, table 2, and Run it.

Now delete all but the first three Rems, and then enter the Basic test program. Save the whole to tape before running as one error could cause a crash. Now Run the test program. If all is well a series of circles will be drawn across the centre of the screen, and then a row of small triangles will be drawn above them. Pressing any key will clear the screen and a series of unfilled triangles will be drawn, each one inside the last. Note that in some cases parts of the shapes are off-screen.

The routine requires five parameters to be Poked into memory before it is called. These are, to draw a line from (a,b) to (c,d):

POKE 16514,a
POKE 16515,b
POKE 16516,c
POKE 16517,d
POKE 16417,PLOT(=1)/Unplot(=0) flag.

Thus, POKE 16417,1

will plot lines to the screen, while

POKE 16417,0

will unplot them.

Note that only 16514 and 16515 have their contents altered by this routine. Thus, if you wish to use one point as the end point for several lines, Poke 16417 with the plot/unplot flag, and then Poke 16516,16517 with the x and y co-ordinates of the point. Then you simply have to alter 16514,16515 each time. Note also that the routine must be called with

LET variable = USR 16527

as

RAND USR 16527

for some unexplained reason produces an error code 4. Type

RUN 10

to illustrate how the changing of just 16514,16515, instead of all five locations, still produces the same result. This should half-fill the screen with black in a triangle.

Now swap lines 20,30 with 50,60, and a very strange effect is produced, which illustrates that on exit from the routine, 16514, 16515 do not necessarily equal 16516,16517, otherwise a straight line from (0,0) to 63,0) would be drawn.

Now type RUN 90

to illustrate the patterns produced by alternatively plotting and unplotting a moving line. Alternatively, add a step of 2 to line 90, change line 100 to

POKE 16417,1

and Run to see the interference pattern produced simply by plotting lines.

Further interesting results can be obtained by RUN 170

Other ideas will doubtless come to mind, and you only have to type them in to see what they will do, remembering that within certain constraints, off-screen drawing is possible. These limits are actually from c.−100 to c.100 for both x and y.

Now on to the circle routine. This routine draws the best possible circle, or ellipse, given the limitations of the ZX-81 display. The routine requires six parameters to be Poked into memory. These are, with their respective addresses:

16444 Radius of circle, or width of ellipse
16445 Radius of circle, or height of ellipse
16446 x-co-ordinate of centre
16447 y-co-ordinate of centre.
16448 filled (=1)/Unfilled (=0) flag
16417 Plot (=1)/Unplot (=0) flag

Note that if a circle is wanted, both 16444 and 16445 should hold the value of the radius, which can range from 1 to c.100. However, for ellipses they may both hold different values in the given range. A value of 0 in either will give very weird results indeed.

It should also be noted that none of these values are altered during execution. The routine is called with:

LET variable = USR 17065.

Circles, especially unfilled ones, seem to work best when superimposed. For instance, try RUN 290

which produces a shell-like pattern. Adding a step of 2 to line 320 can make it seem as though you are looking down a tunnel.

(continued on next page)

Table 1.

16527	-	3A82404 73A84 40A7	=	744
16535	-	983286403A834047	=	724
16543	-	3A85404A798328740	=	823
16551	-	CB7F200CFE002004	=	664
16559	-	3E0018063E011802	=	181
16567	-	3EFF3289403A8640	=	824
16575	-	CB7F200CFE002004	=	664
16583	-	3E0018063E011802	=	181
16591	-	3EFF3288403288A40	=	819
16599	-	3E003288403A8640	=	571
16607	-	FE7F3803EEFF3C32	=	1043
16615	-	8C403A8740FE7F38	=	890
16623	-	03EEFF3C328D4047	=	882
16631	-	3A8C404F78418838	=	786
16639	-	12328C4078328D40	=	647
16647	-	3E00328A403A8940	=	573
16655	-	328B403A8C404FCB	=	797
16663	-	3F328E400C41C53A	=	651
16671	-	2140FE00200443EA0	=	609
16679	-	18023E98CD7941C1	=	827
16687	-	3A8D404F3A8E4081	=	735
16695	-	328E404F3A8C4057	=	684
16703	-	798A381DA79A328E	=	905
16711	-	403A88404F3A8240	=	853
16719	-	81328240 3A89404F	=	711
16727	-	3A8340813283401 8	=	851
16735	-	163A8A404F3A8240	=	613
16743	-	813282403A8B404F	=	713
16751	-	3A83408132834010	=	643
16759	-	A5C932384403A8240	=	780
16767	-	4F3A83404 73E3F89	=	713
16775	-	D83E289008473F01	=	815
16783	4	CB2830023E04CB29	=	803
16791	-	3002CB07F5CDC941	=	976
16799	-	7ECB07FE103007CB	=	864
16807	-	0F3002EE8F47119E	=	692
16815	-	0C3A304093FA8C41	=	832
16823	-	F12FA01802F180FE	=	1145
16831	-	083802EE8F2A0E40	=	867
16839	-	77C93E1790D879E6	=	1116
16847	-	1F4FC5C5AFCB10CB	=	1101
16855	-	10CB1068672929C1	=	717
16863	-	484709C14709ED4B	=	737
16871	-	0C400923220E40C9	=	433

Table 2.

17065	-	21F541065AC5E5E5	=	1094
17073	-	3A3C406E2600E5D1	=	768
17081	-	471910FD3A3E4084	=	681
17089	-	3282403A3D40115A	=	534
17097	-	00E1196E2600E5D1	=	836
17105	-	471910FD3A3F4084	=	682
17113	-	328340CD9443E123	=	925
17121	-	C110CA065AC5E5E5	=	1162
17129	-	3A3C406E2600E5D1	=	768
17137	-	471910FD3A3E4084	=	681
17145	-	3282403A3D40E111	=	669
17153	-	5A00A7ED526E2600	=	724
17161	-	E5D1471910FD3A3F	=	924
17169	-	4094328340CD9443	=	877
17177	-	E123C110C821F541	=	1012
17185	-	065AC5E5E53A3C40	=	933
17193	-	6E2600E5D1471910	=	698
17201	-	FD3A3E4094328240	=	829
17209	-	3A3D40115A00E119	=	540
17217	-	6E2600E5D1471910	=	698
17225	-	FD3A3F4094328340	=	831
17233	-	CD9443E123C110CA	=	1091
17241	-	065AC5E5E53A3C40	=	933
17249	-	6E2600E5D1471910	=	698
17257	-	FD3A3E4094328240	=	829
17265	-	3A3D40E1115A00A7	=	682
17273	-	ED526E2600E5D147	=	976
17281	-	1910FD3A3F408432	=	661
17289	-	8340CD9443E123C1	=	1068
17297	-	10C8C9ED4B82403A	=	981
17305	-	4040FE01200A2A3E	=	529
17313	-	40220440CD8F40C9	=	907
17321	-	3A2140FE0120043E	=	508
17329	-	9B18023EA0CD7941	=	794
17337	-	C9	=	201

Table 3.

17344	-	0603C52A3E402244	=	476
17352	-	40228240 2A404022	=	496
17360	-	4640228440CD8F40	=	776
17368	-	3A4F40FE0028763A	=	671
17376	-	8C40473A8E403248	=	661
17384	-	402A8C4022494 02A	=	523
17392	-	884022 4B402A8A40	=	617
17400	-	224D402A3C402284	=	507
17408	-	40C52A4440228240	=	663
17416	-	CD8F40C13A4A404F	=	880
17424	-	3A484081324 8404F	=	588
17432	-	3A4940577980A3810	=	674
17440	-	A79A3248403A4B40	=	704
17448	-	4F3A44408132444 0	=	580
17456	-	3A4C404F3A454081	=	597
17464	-	3245408163A4D40	=	428
17472	-	4F3A4440813244 40	=	580
17480	-	3A4E404F3A454081	=	599
17488	-	324540 0AC2A3E40	=	539
17496	-	2242402A40402244	=	436
17504	-	40223E402A3C4022	=	424
17512	-	4640224 0402A4240	=	468
17520	-	223C40C105C2C243	=	811
17528	-	C9	=	201

(continued from previous page)

Type RUN 380

to see the advantages and disadvantages of the filled circle routine. It can be seen that, although the filled circle is drawn faster than the series of concentrically placed unfilled circles, and also has the central point filled in, it is less effective at producing a complete fill. Note that changing the For-Next loop in line 420, to FOR K = 0 to 12

will simply result in the weird results already noted for a radius value of 0, and the central point will still not be filled in, in all likelyhood.

Finally, on to the triangle routine. This will draw filled or unfilled triangles as well as possible, using the vertices Poked into memory. Assuming a triangle with vertices (a,b), (p,q), (x,y) the necessary Pokes are:

16444,a
16445,b
16446,p
16447,q
16448,x
16449,y
16463, Filled (=1)/Unfilled (=0) flag
16417, Plot (=1)/Unplot (=0) flag

The routine is then called with

LET variable = USR 17344

A point to note about the filled triangle routine is that it, in fact, draws the triangle three times, once from each vertex. This is to ensure a complete fill of the triangle, but it sometimes means that, although a triangle appears to be complete, in fact the routine has not finished drawing. To see what would result if the routine drew lines from only one vertex, type RUN 510

And now for a warning, or two, actually. First, the plot routine used by these routines, while being much faster than the Sinclair one, will bomb-out if you attempt to plot over writing, or one of the grey character. This is not recommended anyway, as you lose some of the information so carefully placed on the screen. Secondly, if you use Print after using the routines, do not use it on its own, but use Print At. This is because the plot routine resets the system variable DF_CC, while leaving S_POSN alone. Thus the computer might think that it is at (0,0), while in fact it could well be at (16,16). The end result of then using a bare Print statement is to overwrite one of the Newline characters. Result: the computer crashes. However, using, say,

PRINT AT 0,0;

even with nothing following the semi-colon, allows the computer to set its house in order.

Test program.

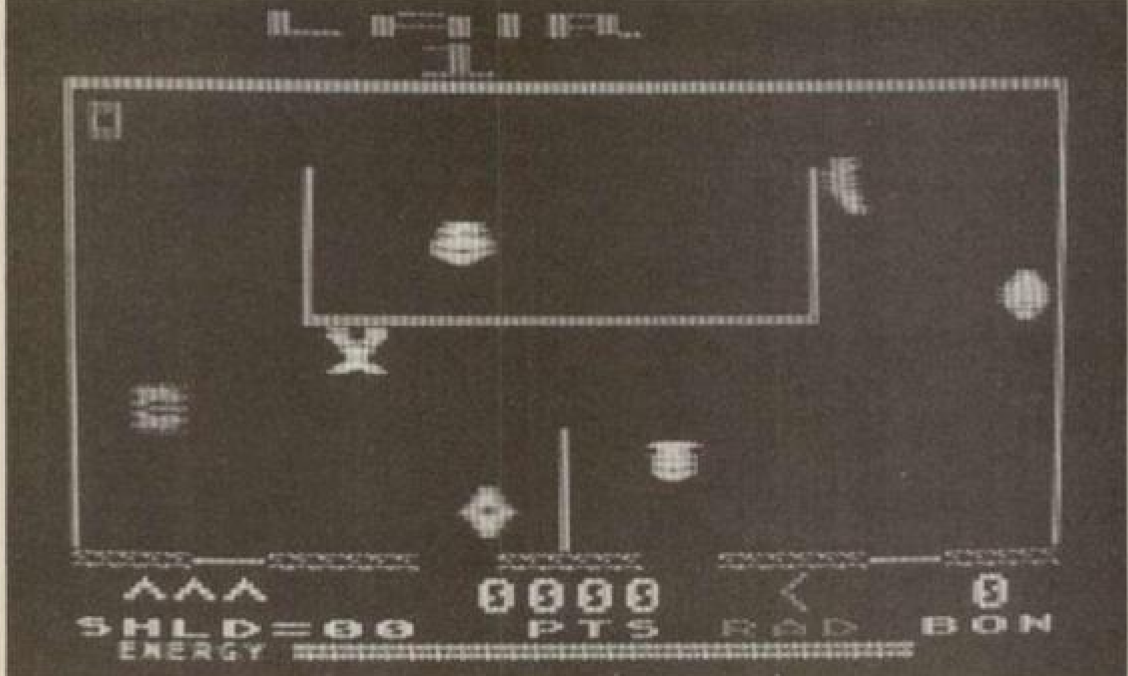
```
   4 REM  DRAW (C) J.COLLYER 1983
   5 GOTO 9500
  10 POKE 16417,1
  20 POKE 16516,63
  30 POKE 16517,43
  40 FOR K=0 TO 63
  50 POKE 16514,K
  60 POKE 16515,0
  70 LET L=USR 16527
  80 NEXT K
  85 STOP
  90 FOR K=0 TO 63
 100 POKE 16417,0+(K/2<>
     INT (K/2
 110 POKE 16514,63-K
 120 POKE 16515,43
 130 POKE 16516,K
 140 POKE 16517,0
 150 LET L=USR 16527
 160 NEXT K
 165 STOP
 170 FOR K=0 TO 44 STEP 2
 180 POKE 16417,1
 190 POKE 16514,63
 200 POKE 16515,22
 210 POKE 16516,0
 220 POKE 16517,K
 230 LET L=USR 16527
 240 POKE 16514,0
 250 POKE 16515,21
 260 POKE 16516,63
 270 POKE 16517,K
 275 LET L=USR 16527
 280 NEXT K
 285 STOP
 290 POKE 16417,1
 300 POKE 16448,0
 310 POKE 16446,32
 320 FOR K=1 TO 20
 330 POKE 16444,K
 340 POKE 16445,K
 350 POKE 16447,K
 360 LET L=USR 17065
 370 NEXT K
 375 STOP
 380 POKE 16417,1
 390 POKE 16448,0
 400 POKE 16446,50
 410 POKE 16447,22
 420 FOR K=1 TO 12
 430 POKE 16444,K
 440 POKE 16445,K
 450 LET L=USR 17065
 460 NEXT K
 480 POKE 16443,1
 490 POKE 16446,12
 500 LET L=USR 17065
 505 STOP
 510 POKE 16444,0
 520 POKE 16445,0
 530 POKE 16446,43
 540 POKE 16447,43
 550 POKE 16448,63
 560 POKE 16449,20
 570 POKE 16463,1
 580 POKE 16417,1
 590 LET L=USR 17344
 595 STOP
9500 POKE 16417,1
9510 POKE 16444,10
9520 POKE 16445,10
9530 POKE 16447,22
9540 POKE 16448,0
9550 FOR K=69 TO -6
     STEP -5
9560 POKE 16446,K
9570 LET L=USR 17065
9580 NEXT K
9590 POKE 16417,1
9600 POKE 16445,36
9610 POKE 16447,34
9620 POKE 16449,34
9630 POKE 16463,1
9640 FOR K=2 TO 63 STEP 4
9650 POKE 16444,K
9660 POKE 16446,K-2
9670 POKE 16448,K+2
9690 LET L=USR 17344
9700 NEXT K
9710 IF INKEY$="" THEN
     GOTO 9710
9715 CLS
9720 POKE 16463,0
9730 POKE 16444,32
9740 FOR K=64 TO 4
     STEP -4
9750 POKE 16445,22+K
9760 POKE 16447,22-K
9770 POKE 16449,22-K
9780 POKE 16446,32-K
9790 POKE 16448,32+K
9800 LET L=USR 17344
9810 NEXT K
9820 STOP
```



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THE LAIR

D Hitchens invites you and your Atari 400/800 to enter the lair and make a fortune — provided you don't get killed.



YOUR MISSION IS to search the Lair for four pieces of hidden treasure and recover them safely.

Radar is your sole aid to quickly locating the hidden treasure. As soon as you have entered the Lair, an indicator will appear in red to point in the horizontal direction in which the treasure is hidden. Your radar will not tell you its precise location but it will inform you of its approximate horizontal position. When the indicator changes to ◇ your treasure will lie somewhere within a vertical band around this position. On a first-playing of the game, experiment in its use and ignore the monsters.

Picking up the treasure is automatically achieved when you pass over it. You will hear a short musical tone and the radar indicator will change into a home market — * — into which you must deposit your prize. Before you can do this, however, you must stake your claim by reporting to the office just inside the lair's boundary, top left. Simply position your

```
0 REM ** MONSTERS' LAIR **                    ** DAVE HITCHENS (c) 1983 **
1 REM
10 SOUND 0,0,0,0:GOSUB 7000:GOTO 100
20 ENERGY=ENERGY+600-EN:EN=600:A=USR(PMB3+500):SHIELD=9:POKE 656,2:POK
E 657,9:FOR N=1 TO 30:? "*";:NEXT N:RETURN
25 BONUSPTS=BONUSPTS+1-(BONUSPTS=9):POKE 656,1:POKE 657,18:? CHR$(144+
BONUSPTS);:RETURN
30 FOR N=30 TO 80 STEP 10:SOUND 2,N,10,9:NEXT N:FOR N=80 TO 30 STEP -1
0:SOUND 2,N,10,12:NEXT N:SOUND 2,0,0,0
32 POKE 656,1:POKE 657,13:? " ";CHR$(170);" ";:POKE PMB3+230,D2+2:RETU
RN
35 SOUND 2,10,0,15:A=2^2:FOR N=15 TO 0 STEP -0.5:SOUND 2,50,0,N:NEXT N
:RETURN
40 FOR N=15 TO 0 STEP -0.25:SOUND 2,100+N/5,12,N:NEXT N:RETURN
100 REM INITIALISING
105 DIM SCORE(4),ENERGY(4),TIME(4)
120 GRAPHICS 5:POKE 559,0:GOSUB 5000:GOSUB 4000:POKE 752,1:POKE 623,24
:POKE 82,0:SOUND 1,0,0,0:SOUND 2,0,0,0
121 IF DIFF THEN D2=3:D3=20:D6=6:D4=PMBASE2+2
122 IF  NOT DIFF THEN D2=4:D3=40:D6=5:D4=210
123 POKE PMB3+147,D3:POKE 1562,D6:GOSUB 1900
124 POKE 708,38:POKE 709,198:POKE 710,0:POKE 711,72:GOSUB 3800
125 GOSUB 3000
130 FOR N=1 TO 50:RESTORE 1800+10*RND(0):READ D:SOUND 1,D,10,5:SOUND 2
,D+1,10,5
135 FOR DA=1 TO 10*RND(0)+15:NEXT DA:NEXT N:FOR DA=5 TO 0 STEP -0.2:SO
UND 1,D,10,DA:SOUND 2,D,10,DA:NEXT DA
138 POKE 53761,130:POKE 53277,3
140 IF PRIZE<2 THEN COLOR 1:GOSUB 2000
150 IF PRIZE=0 THEN X=3:Y=3:GOSUB 2500
500 REM MAIN LOOP - BASIC
510 IF PEEK(632)<>15 THEN EN=EN-1:IF  NOT EN THEN GOTO 1500
520 POKE 656,2:POKE 657,9+EN/20:? " ";
530 IF EN<150 AND  NOT PEEK(1710) THEN A=USR(PMB3+400):POKE 1664,0
540 IF EN<100 THEN POKE 712,60:POKE 712,0
550 IF PEEK(20)<20 THEN EN=EN-1+(EN=1)
560 IF PEEK(1602)<190 THEN 600
570 POKE 53278,0:IF PRIZE=3 AND PEEK(1600)=162 AND PEEK(1602)=201 THEN
 GOTO 1600
580 POKE 77,0:GOTO 500
600 IF PEEK(1602)<25 OR PEEK(1600)<48 OR PEEK(1600)>206 THEN GOTO 1500
610 IF PEEK(53248)=1 AND PEEK(632)=15 AND PEEK(644)=0 AND PRIZE=1 THEN
 PRIZE=2:GOSUB 40:COLOR 0:GOSUB 2000
620 IF PEEK(53248)=2 OR PEEK(53248)=3 THEN SHIELD=SHIELD-4:BONUS=0:GOS
UB 35:IF PEEK(53248)=3 THEN 1500
622 IF PEEK(53256)=1 THEN SHIELD=SHIELD-1:BONUS=0:GOSUB 35
625 IF SHIELD<0 THEN POKE 656,1:POKE 657,25:? "0";:GOTO 1500
630 POKE 656,1:POKE 657,25:? CHR$(SHIELD+176);
640 IF PEEK(53248)=4 THEN PRIZE=1:COLOR 0:PLOT X,Y:GOSUB 30
650 IF PEEK(53256)=8 AND PEEK(632)=15 AND  NOT PEEK(644) THEN GOSUB 20
660 IF PEEK(53248)=8 AND (PRIZE=0 OR PRIZE=1) THEN GOTO 1500
670 IF PEEK(53248)=8 AND PRIZE=2 THEN PRIZE=3:GOTO 500
690 POKE 53278,0
700 REM BONUS
710 IF PEEK(632)<=
;0BONUS=BONUS+1:SOUND 2,20*(PRIZE>0),0,15:SOUND 2,0,0,0:IF BONUS=75 TH
EN GOSUB 25:BONUS=0
800 REM RADAR
805 IF PRIZE THEN 900
810 X1=(PEEK(1600)-48)/2:POKE 656,1:POKE 657,13
820 IF X1<X-2 THEN ? " ";CHR$(27);CHR$(30);" ";:GOTO 900
830 IF X1>X+2 THEN ? " ";CHR$(27);CHR$(28);" ";:GOTO 900
840 ? CHR$(9);" ";CHR$(8);
900 IF  NOT PEEK(558) AND  NOT PRIZE THEN GOSUB 2500
1000 GOTO 500
1300 RESTORE 1350
1310 FOR N=1 TO 11:READ DA,DB:SOUND 1,DA,10,8:SOUND 2,DA+3,10,8:FOR A=
1 TO DB:NEXT A
1320 FOR A=8 TO 4 STEP -0.2:POKE 53763,160+A:POKE 53765,160+A:NEXT A:N
EXT N:SOUND 1,0,0,0:SOUND 2,0,0,0:RETURN
1350 DATA 193,140,193,100,193,15,193,140,162,115,173,20,173,100,193,30
,193,105,204,50,193,150
1400 POKE 53761,0:POKE 53277,0:FOR N=53261 TO 53265:POKE N,0:NEXT N
1410 POKE 656,1:POKE 657,13:? "   ";:RETURN
1500 COLOR 0:PLOT X,Y:GOSUB 1400:LIVES=LIVES-1:POKE 1710,0:A=USR(1572)
:IF LIVES=0 THEN 8000
1520 GOSUB 1300:EN=600:SHIELD=9:DEAD=1:PRIZE=0:BONUS=0:BONUSPTS=0:POKE
 656,1:POKE 657,18:? CHR$(144);
1530 POKE 656,2:POKE 657,9:FOR N=1 TO 30:? "*";:NEXT N:POKE 656,1:POKE
 657,25:? CHR$(185);
1540 GOSUB 3000:GOTO 138
1600 GOSUB 1400:POKE 53761,0:A=USR(1572):A=USR(PMB2+200,LAIR):ENERGY=E
NERGY+600-EN
1610 TIME(LAIR)=INT((256*PEEK(19)+PEEK(20))/50):ENERGY(LAIR)=ENERGY
1620 SCORE(LAIR)=1500-(TIME(LAIR)*10)-ENERGY(LAIR)+(BONUSPTS*250)+(SHI
ELD*100)+(LIVES*125)
1630 POKE 656,1:POKE 1710,0:IF SCORE(LAIR)<10 THEN SCORE(LAIR)=INT(100
*RND(0)+10)
1640 FOR N=SCR TO SCR+SCORE(LAIR) STEP 5:POKE 657,12-LEN(STR$(N)):? N;
:SOUND 1,10,12,15:SOUND 1,0,0,0:NEXT N
1645 SCR=SCR+SCORE(LAIR)
1650 A=2^2^2:ENERGY=0:LAIR=LAIR+1:IF LAIR=5 THEN 8000
1660 OFFSET=OFFSET+22:BONUS=0:BONUSPTS=0:POKE 19,0:POKE 20,0:PRIZE=0
1670 GOTO 125
1700 STOP
1800 DATA 230
1801 DATA 173
1802 DATA 114
1803 DATA 85
1804 DATA 57
1805 DATA 42
1806 DATA 50
1807 DATA 68
1808 DATA 76
1809 DATA 102
1810 DATA 136
1811 DATA 153
1900 RESTORE 1920
1910 FOR N=1 TO 8:READ D:POKE PMB1+D,D4:NEXT N:RETURN
1920 DATA 18,60,102,144,186,274,316,358
2000 PLOT 2,2:DRAWTO 2,4:DRAWTO 4,4:DRAWTO 4,2:DRAWTO 2,2:RETURN
2500 REM PLACE PRIZE
2510 COLOR 0:PLOT X,Y
2520 X=INT(RND(0)*79):Y=INT(RND(0)*39):LOCATE X,Y,Z:IF Z THEN 2520
2530 COLOR 3:PLOT X,Y
2540 A=USR(PMB3+300):A=USR(1556):POKE 1664,0:RETURN
3000 POKE PMB3+230,D2:REM LAIR START
3100 FOR N=0 TO 10:POKE PMB3+1300+N,PEEK(PMB2+OFFSET+N):NEXT N
```

explorer over the office, release the joystick and press the controller button.

If your claim is accepted, the office will disappear. Move away at once since you are not immune from monster attack even when reporting at the office. finally, leaving the lair only by one of the pink doorways and deposit your treasure at the home symbol by positioning your man directly over it. There is no need to press the controller button — your prize will be automatically registered providing you have completed the procedures outlined above.

After a brief interlude, Lair 2 will appear followed, by turn, by Lairs 3 and 4, each containing one piece of treasure. Successful recovery of all four pieces of treasure ends the game by disclosing a scoresheet of your performance.

The eight monsters roam incessantly and unpredictably. When playing the game for the first time, pause before entering the lair in order to become more familiar with their wanderings. Collision with a monster will reduce your shield energy by 10 points unless you are fortunate enough to meet him during his re-energising process. All monsters re-energise frequently but unpredictably — always treat them with respect.

Energy is depleted continuously as you move around but movement within the lair is far less expensive than movement beneath it — ensure you have sufficient energy to complete your mission. While stationary you consume only a small amount of life support energy so you may leave the lair at any time via a black doorway and come to rest below. Your current energy level is shown on the bar graph at the bottom of the screen. When your energy drops to 30 percent of its starting value, an energy pod will appear within the walls of the lair, top right; if energy becomes dangerously low, the screen will flash red. To replenish your supply, dock with the pulsating pod — be very wary of the Devil! — release the joystick and press the red controller button. Vacate the area as soon as the re-energising process is complete since you are vulnerable while stationary. The process simultaneously repairs damaged shields and restores them to maximum.

You are equipped initially with armour to protect you from inadvertant collisions with the walls and barriers of the lair and its residents. Current shield energy is shown in white beneath the lair. Ten points are lost if you collide with a monster; 40 if you touch a wall or barrier. If your shield energy falls to zero any future collision will be fatal.

If your shields are down it is advisable to consume energy safely beneath the lair in order to activate the pod — you may pass safely anywhere in this area.

You begin the game with five explorers. Your current explorer will flash yellow while beneath the lair signifying that it is safe to travel anywhere within that zone. On entering the lair he will change to flashing purple to warn of the restricted movements allowed there. You forfeit one life if your main energy falls to zero; you collide with Monsters or barrier while your shields are down; you attempt to enter the lair other than via the black doorways; you attempt to escape from the lair other than via a pink or black doorway. Forfet all five lives and the game ends.

Bonus points are awarded if you are able to avoid collisions within the lair for an extended period of time. The current value is shown in yellow to the right of the radar indicator. A high value will enhance your score and will be carried over into subsequent lairs unless your explorer dies.

Treasure is positioned randomly at the beginning of each lair and also at regular intervals thereafter until discovered — you cannot afford to dally while searching! A warning bell will sound when the treasure is repositioned together with a pulsating prize symbol above the walls of the lair, top right.

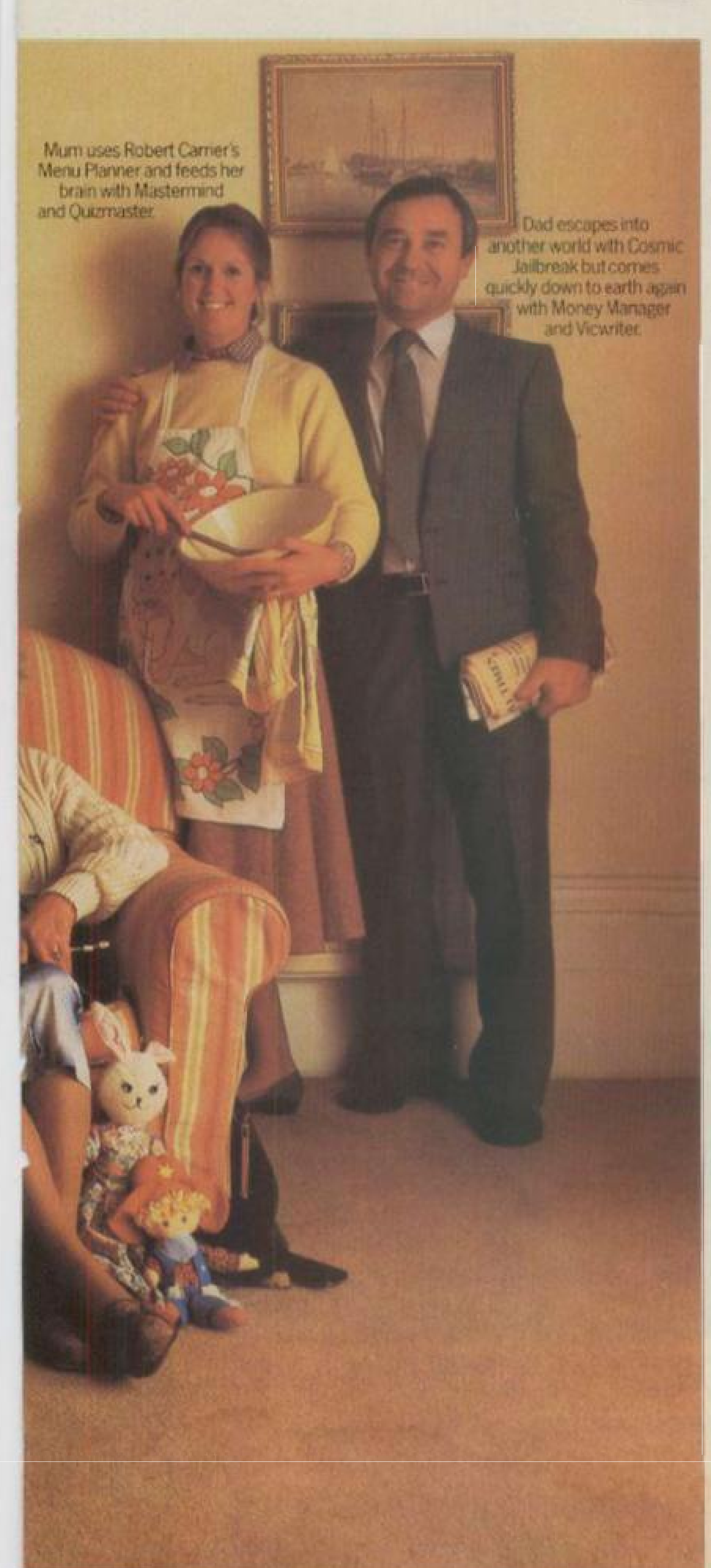
```
3110 FOR N=0 TO 10:POKE PMB3+1556+N,PEEK(PMB2+OFFSET+11+N):NEXT N
3120 RESTORE 3125:FOR N=PMB2+972 TO PMB2+978:READ D:POKE N,D:NEXT N
3125 DATA 1,1,7,1,1,1,6
3130 POKE 1600,XPOS+LIVES*8:POKE 1601,3:POKE 1602,201:POKE 1604,213:PO
KE 1605,1
3140 POKE 656,1:POKE 657,LIVES:? " ";
3190 IF DEAD=1 THEN DEAD=0:RETURN
3200 POKE 656,0:POKE 657,0:COLOR 2:ON LAIR GOTO 3500,3510,3520,3530
3500 ? "%%%%%%%%%%%  %%%%%%  %%%%%%%%%%%";
3505 PLOT 39,39:DRAWTO 39,29:PLOT 19,7:DRAWTO 19,19:DRAWTO 59,19:DRAWT
O 59,7:RETURN
3510 REM LAIR 2
3515 PLOT 39,0:DRAWTO 39,12:PLOT 0,14:DRAWTO 8,14:PLOT 71,14:DRAWTO 79
,14:PLOT 39,20:DRAWTO 39,25
3517 PLOT 7,32:DRAWTO 16,32:PLOT 63,32:DRAWTO 72,32:RETURN
3520 REM LAIR 3
3523 PLOT 22,36:DRAWTO 57,36
3526 PLOT 46,19:DRAWTO 39,12:POSITION 32,19:POKE 765,2:XIO 18,#6,0,0,"
S:":RETURN
3530 REM LAIR 4
3533 PLOT 16,32:DRAWTO 25,23:PLOT 63,32:DRAWTO 54,23:PLOT 16,32:DRAWTO
 22,36:PLOT 63,32:DRAWTO 57,36
3536 PLOT 16,11:DRAWTO 10,4:POSITION 4,11:POKE 765,2:XIO 18,#6,0,0,"S:
"
3537 PLOT 75,11:DRAWTO 69,4:POSITION 63,11:POKE 765,2:XIO 18,#6,0,0,"S
:"
3539 RETURN
3710 RETURN
3800 REM GAME START
3810 LAIR=1:OFFSET=0:ENERGY=0:TIME=0:EN=600:BONUS=0:BONUSPTS=0:SHIELD=
9:LIVES=5:XPOS=51:PRIZE=0:SCR=0
3820 FOR N=0 TO 4:TIME(N)=0:ENERGY(N)=0:SCORE(N)=0:NEXT N
3830 POKE 656,1:POKE 657,1:FOR N=1 TO LIVES:? CHR$(27);CHR$(254);:NEXT
 N
3840 POKE 657,6:? "  0000       ";CHR$(144);" SHLD=90  PTS rad bon";
3850 ? "  ENERGY ";:FOR N=1 TO 30:? "*";:NEXT N
3860 COLOR 2:PLOT 0,39:DRAWTO 0,0:DRAWTO 79,0:DRAWTO 79,39
3870 POKE 705,230:POKE 706,230
3885 POKE 18,0:POKE 19,0:POKE 20,0:A=USR(1572)
3890 POKE 559,62:POKE 1664,0:A=USR(1536):POKE 1710,0
3900 RETURN
3997 REM
3998 REM INSERT DLI'S
3999 REM
4000 DL=PEEK(560)+PEEK(561)*256
4010 RESTORE 4020:FOR N=1 TO 12:READ D,DT:POKE DL+D,DT:NEXT N
4020 DATA 3,202,10,138,15,138,19,138,24,138,29,138,34,138,38,138,45,19
6,48,7,49,6,50,4
4030 IF PEEK(PMB1)=72 THEN RETURN
4032 SOUND 1,108,10,2:SOUND 2,109,10,2
4035 RESTORE 4050
4040 FOR N=0 TO 216:READ D:POKE PMB1+N,D:NEXT N:FOR N=0 TO 171:READ D:
POKE PMB1+256+N,D:NEXT N
4048 REM MONSTER 1 DLI (PHASE 1/2/3)
4050 DATA 72,138,72,216,162,1,189,128,6,56,233,1,201,255,208,3,173,10,
210,141,10,212
4051 DATA 141,0,208,157,128,6,169,40,141,18,208
4052 DATA 169,42,141,0,2,104,170,104,64
4058 REM MONSTER 2
4060 DATA 72,138,72,216,162,2,189,128,6,24,105,1,201,255,208,3,173,10,
210,141,10,212
4061 DATA 141,0,208,157,128,6,169,200,141,18,208
4062 DATA 169,84,141,0,2,104,170,104,64
4068 REM MONSTER 3
4070 DATA 72,138,72,216,162,3,189,128,6,56,233,1,201,255,208,3,173,10,
210,141,10,212
4071 DATA 141,0,208,157,128,6,169,74,141,18,208
4072 DATA 169,126,141,0,2,104,170,104,64
4078 REM MONSTER 4
4080 DATA 72,138,72,216,162,4,189,128,6,24,105,1,201,255,208,3,173,10,
210,141,10,212
4081 DATA 141,0,208,157,128,6,169,218,141,18,208
4082 DATA 169,168,141,0,2,104,170,104,64
4088 REM MONSTER 5
4090 DATA 72,138,72,216,162,5,189,128,6,24,105,1,201,255,208,3,173,10,
210,141,10,212
4091 DATA 141,0,208,157,128,6,169,154,141,18,208
4092 DATA 174,1,2,232,142,1,2,169,0,141,0,2,104,170,104,64
4098 REM MONSTER 6
4100 DATA 72,138,72,216,162,6,189,128,6,56,233,1,201,255,208,3,173,10,
210,141,10,212
4101 DATA 141,0,208,157,128,6,169,248,141,18,208
4102 DATA 169,42,141,0,2,104,170,104,64
4108 REM MONSTER 7
4110 DATA 72,138,72,216,162,7,189,128,6,24,105,1,201,255,208,3,173,10,
210,141,10,212
4111 DATA 141,0,208,157,128,6,169,106,141,18,208
4112 DATA 169,84,141,0,2,104,170,104,64
4118 REM MONSTER 8
4120 DATA 72,138,72,216,162,8,189,128,6,56,233,1,201,255,208,3,173,10,
210,141,10,212
4121 DATA 141,0,208,157,128,6,169,136,141,18,208
4122 DATA 169,126,141,0,2,104,170,104,64
4128 REM TEXT WINDOW DLI
4130 DATA 72,138,72,152,72,162,54,160,10,169,120
4131 DATA 141,10,212,141,22,208,142,23,208,140,24,208,169,26,141,25,20
8
4132 DATA 174,1,2,202,142,1,2,169,0,141,0,2,104,168,104,170,104,64
4201 REM USR CALLS: START/STOP/TIMER & PLAYER 4 OFF
4202 RESTORE 4250
4210 FOR N=1536 TO 1592:READ D:POKE N,D:NEXT N
4250 DATA 104,160,0,166,208,169,6,76,92,228
4251 DATA 104,160,95,162,228,169,6,76,92,228
4252 DATA 104,169,5,160,0,162,6,32,92,228,169,192,141,14,212,96
4254 DATA 104,162,255,169,0,157,0,0,157,0,0,157,0,0,157,0,0,202,208,24
1,96
4260 POKE 1579,PMBASE2+3:POKE 1582,PMBASE1+7:POKE 1585,PMBASE2+7:POKE
1588,PMBASE2+7
4290 SOUND 1,80,10,2:SOUND 2,81,10,2
4301 REM VBI DATA
4310 FOR N=PMB3 TO PMB3+236:READ D:POKE N,D:NEXT N
4350 DATA 174,128,6,224,0,208,19,169,0,141,0,2,165,204,141,1,2,169,192
,141,14,212,232,142,128,6
4351 DATA 174,139,6,232,142,139,6
4352 DATA 224,20,208,10,165,204,162,0,142,139,6,108,144,6
4353 DATA 224,15,208,5,165,207,108,144,6
```

(listing continued on page 115)

How to progra with a VIC 2



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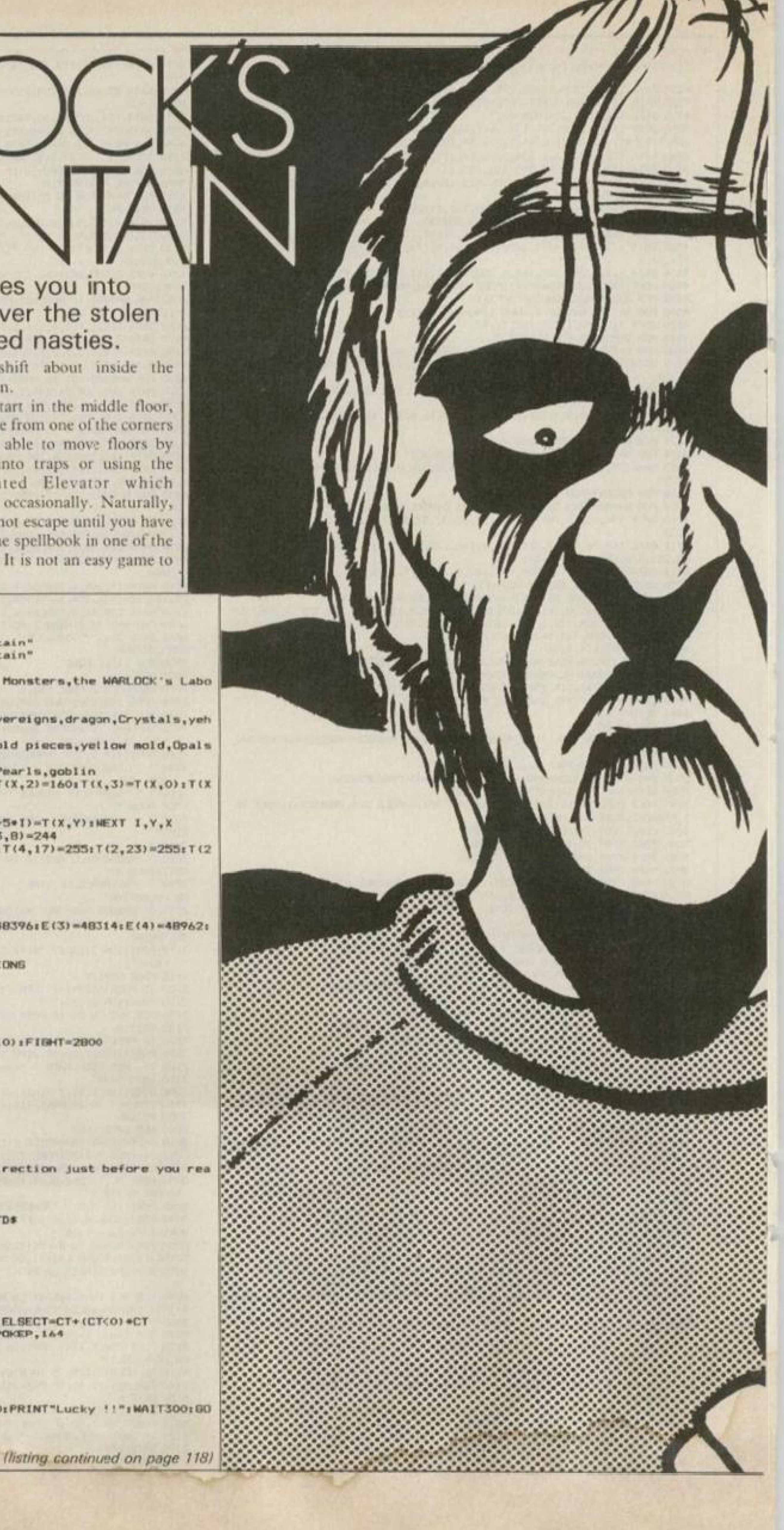



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(listing continued from page 111)

```
4354 DATA 224,10,208,5,165,208,108,144,6
4355 DATA 224,5,208,5,165,207,141,7,212
4360 DATA 174,42,2,224,0,208,77
4370 DATA 173,10,210,201,128,16,7,162,56,160,233,108,151,6,162,24,160,
105,142,149,6,140,150,6,41,7,216,24,105,1
4380 DATA 170,188,164,6,224,5,16,14,173,149,6,145,203,200
4390 DATA 173,150,6,145,203,108,153,6
4400 DATA 173,149,6,145,205,200,173,150,6,145,205,169,3,160,250,162,0,
32,92,228,169,192,141,14,212
4410 DATA 165,20,141,195,2,173,10,210,141,0,210
4420 DATA 174,69,6,240,60,206,65,6,208,55
4430 DATA 173,120,2,41,1,208,3,32,0,0,173,120,2,41,2,208,3,32,0,0
4440 DATA 173,120,2,41,4,208,3,206,64,6,173,120,2,41,8,208,3,238,64,6,
174,64,6
4450 DATA 142,4,208,232,142,5,208,162,3,142,65,6,76,95,228
4460 POKE PMB3+188,PMBASE2+1:POKE PMB3+198,PMBASE2+1:POKE PMB3+197,50
4498 REM AND CORRESPONDING OFFSETS
4500 FOR N=1 TO 8:READ D:POKE 1700+N,D:NEXT N
4510 DATA 9,51,93,135,177,9,51,93
4598 REM USR DATA FOR PLAYER 3
4600 FOR N=PMB3+300 TO PMB3+366:READ D:POKE N,D:NEXT N
4610 DATA 104,162,0,189,214,6,157,16,0,157,16,0,157,16,0,232,224,15,20
8,239
4611 DATA 162,0,169,200,141,6,210,160,0,200,192,250,208,251,233,4,201,
40,208,240,232,224,20,208,233,169,0
4612 DATA 141,6,210,162,0,157,16,0,157,16,0,157,16,0,232,224,15,208,24
2,96
4629 REM PRIZE & ENERGY POD CHARS.
4630 FOR N=1750 TO 1770:READ D:POKE N,D:NEXT N
4635 DATA 28,99,65,99,127,62,62,28,28,8,8,8,8,28,62,224,160,224,224,16
0,224
4698 REM ENERGY POD ON : USR DATA
4700 FOR N=PMB3+400 TO PMB3+455:READ D:POKE N,D:NEXT N
4710 DATA 104,162,0,189,229,6,157,38,0,157,38,0,157,38,0,232,224,6,208
,239
4711 DATA 169,30,141,2,210,169,0,160,175,140,3,210,162,0,232,224,250,2
08,251,136,192,159,208,241
4712 DATA 105,1,201,16,208,233,162,1,142,174,6,96
4798 REM USR DATA: ENERGY POD OFF
4800 FOR N=PMB3+500 TO PMB3+549:READ D:POKE N,D:NEXT N
4810 DATA 104,162,0,169,0,157,38,0,157,38,0,157,38,0,232,224,6,208,242
4811 DATA 162,204,142,3,210,160,250,140,2,210,162,0,232,224,250,208,25
1,136,192,20,208,241,162,0,142,3,210
4812 DATA 142,174,6,96
4850 FOR N=1 TO 4:READ DA,DB,DC:POKE PMB3+DA,PMBASE1+7:POKE PMB3+DB,PM
BASE2+7:POKE PMB3+DC,PMBASE3+7:NEXT N
4860 DATA 308,311,314,354,357,360,408,411,414,507,510,5:3
4870 REM ENABLE PLYR3 CHARS TO PMSETS
4900 RETURN
4998 REM PM SET-UP
5000 PMBASE1=PEEK(106)-16:PMBASE2=PMBASE1-8:PMBASE3=PMBASE2-8:POKE 542
79,PMBASE1
5010 POKE 53774,0:POKE 16,0
5020 PMB1=PMBASE1*256:PMB2=PMBASE2*256:PMB3=PMBASE3*256
5058 REM PAGE 0/6 INDEXED ADDRESSING
5060 POKE 203,0:POKE 204,PMBASE1:POKE 205,0:POKE 206,PMBASE1+1:POKE 20
7,PMBASE2:POKE 208,PMBASE3
5065 POKE 1680,71:POKE 1681,PMBASE3
5066 POKE 1687,99:POKE 1688,PMBASE3
5067 POKE 1689,144:POKE 1690,PMBASE3
5070 POKE PMB2+512+10,255
5090 POKE 53251,190:POKE 53259,1:POKE 53249,80:POKE 53250,112:POKE 532
57,3:POKE 53258,3:POKE 53767,165
5998 REM MONSTER CHARACTER SETS
6000 RESTORE 6050
6005 IF PEEK(PMB1)=72 THEN RETURN
6008 SOUND 1,217,10,2:SOUND 2,218,10,2:POKE 53767,172
6010 FOR N=0 TO 36:POKE PMB1+1024+N,0:NEXT N
6015 FOR N=187 TO 255:POKE PMB1+1024+N,0:NEXT N
6020 FOR N=37 TO 186:READ DT:POKE PMB1+1024+N,DT:NEXT N
6025 FOR N=0 TO 36:POKE PMB2+1024+N,0:NEXT N
6030 FOR N=187 TO 255:POKE PMB2+1024+N,0:NEXT N
6035 FOR N=37 TO 186:READ DT:POKE PMB2+1024+N,DT:NEXT N
6040 FOR N=0 TO 36:POKE PMB3+1024+N,0:NEXT N
6042 FOR N=187 TO 255:POKE PMB3+1024+N,0:NEXT N
6044 FOR N=37 TO 186:READ DT:POKE PMB3+1024+N,DT:NEXT N
6048 REM SET 1
6050 DATA 0,99,34,20,20,62,127,42,62,62,62,62,62,62,20,20,28,0,0,0
6051 DATA 28,12,28,28,56,56,28,60,24,60,24,56,112,96,96,224,192,192,0,
0
6052 DATA 60,60,126,90,90,126,255,255,189,195,255,126,60,24,0,0
6053 DATA 0,24,24,60,36,126,102,255,126,255,126,255,126,126,60,60,24,2
4,0,0
6054 DATA 195,194,195,195,102,102,36,60,60,24,24,24,60,126,102,66,66,6
6,0,0
6055 DATA 85,85,254,254,127,127,230,194,91,91,194,230,127,127,254,254,
85,85,0,0
6056 DATA 126,255,60,60,60,126,219,126,126,90,102,126,60,24,0,0
6057 DATA 0,0,0,0,0,24,60,126,231,126,60,24,0,0,0,0,0,0
6058 REM SET 2
6060 DATA 65,34,34,20,20,62,127,42,62,62,62,62,62,62,28,20,28,0,0,0
6061 DATA 28,20,28,28,56,56,28,56,28,56,28,28,28,28,56,20,24,24,0,0
6062 DATA 60,60,126,90,90,126,255,255,189,195,255,126,60,24,0,0
6063 DATA 0,24,24,60,60,126,126,255,102,255,102,255,126,126,60,60,24,2
4,0,0
6064 DATA 195,66,195,195,102,102,36,60,60,24,24,24,60,126,102,66,195,1
95,0,0
6065 DATA 170,170,127,127,254,254,103,67,218,218,67,103,254,254,127,12
7,172,172,0,0
6066 DATA 126,255,60,60,60,255,90,126,126,90,102,126,60,24,0,0
6067 DATA 0,0,0,24,24,60,60,102,231,126,60,60,24,24,0,0,0,0
6068 REM SET 3
6070 DATA 34,34,34,20,20,62,127,42,62,62,62,62,62,62,20,20,28,0,0,0
6071 DATA 28,24,28,28,56,56,28,56,28,56,28,28,14,14,6,7,3,3,0,0
6072 DATA 60,60,126,122,90,126,255,255,189,195,255,126,60,24,0,0
6073 DATA 0,24,24,60,60,126,126,255,126,255,126,255,102,126,36,60,24,2
4,0,0
6074 DATA 195,67,195,195,102,102,36,60,60,24,24,24,60,126,102,195,0,0,
0,0
6075 DATA 85,85,254,254,127,127,230,194,91,91,194,230,127,127,254,254,
85,85,0,0
6076 DATA 126,255,60,60,189,126,90,126,126,90,102,126,60,24,0,0
6077 DATA 24,24,24,60,60,60,126,102,231,231,126,126,60,60,60,24,24,24
6098 REM PLYR 1/2 CHAR. SETS
6100 SOUND 1,162,10,2:SOUND 2,163,10,2
6110 FOR M=PMB3 TO PMB1 STEP 2048:RESTORE 6120:FOR N=M+1280 TO M+1310:
READ D:POKE N,D:NEXT N
6113 FOR N=M+1536 TO M+1566:READ D:POKE N,D:NEXT N
6116 NEXT M
6120 DATA 0,0,0,0,0,0,0,0,0,134,137,137,137,143,137,233,233,0,0,0,0,
0,0,0,0,0,0,0,0,0
6130 DATA 0,0,0,0,0,0,0,0,0,92,84,84,84,92,84,86,82,0,0,0,0,0,0,0,0,
0,0,0,0,0
6140 POKE 53249,80:POKE 53250,112:POKE 53257,3:POKE 53258,3:REM POS. O
N SCREEN
6150 FOR N=PMB2 TO PMB2+87:READ D:POKE N,D:NEXT N:REM 705/706 CHAR FOR
 "1:2:3:4"
6160 DATA 1,3,1,1,1,1,1,1,1,3,3,0,0,0,0,0,0,0,0,0,128,128
6170 DATA 3,4,0,0,1,2,4,4,4,7,7,0,128,128,128,0,0,0,0,0,128,128
6180 DATA 7,0,1,2,3,0,0,0,4,3,3,128,128,0,0,0,128,128,128,128,0,0
6190 DATA 1,3,5,13,13,15,1,1,1,1,1,0,0,0,0,0,192,0,0,0,0,0
6200 FOR N=PMB2+100 TO PMB2+137:READ D:POKE N,D:NEXT N
6210 DATA 104,169,24,141,1,210,162,0,169,40,160,0
6220 DATA 200,196,250,208,251,141,0,210,169,160,160,0
6230 DATA 200,196,250,208,251,141,0,210,232,224,190,208,227,96
6300 FOR N=PMB2+200 TO PMB2+253:READ D:POKE N,D:NEXT N:REM HAPPY SOUND
6310 DATA 104,104,104,10,10,162,170,142,5,210,162,200,142,4,210
6320 DATA 160,250,136,208,253,202,224,5,208,243,56,233,1,208,238
6330 DATA 162,5,142,4,210,160,250,136,208,253,232,224,250,208,243,162,
0,142,4,210,142,5,210,96
6400 FOR N=PMB2+256 TO PMB2+290:READ D:POKE N,D:NEXT N:REM PLYR 4 MOVE
 UP
6410 DATA 172,66,6,206,66,6,206,66,6,200,200,200,185,0,0,136,136,153,0
,0,200,200,200,204,68,6,208,240
6420 DATA 206,68,6,206,68,6,96
6430 FOR N=PMB2+256+50 TO PMB2+256+84:READ D:POKE N,D:NEXT N:REM PLYR
4 DOWN
6440 DATA 172,68,6,238,68,6,238,68,6,136,136,136,185,0,0,200,200,153,0
,0,136,136,136,204,66,6,208,240
6450 DATA 238,66,6,238,66,6,96
6460 FOR N=1 TO 4:READ D:POKE PMB2+D,PMBASE2+3:NEXT N
6470 DATA 270,275,320,325
6800 RETURN
7000 REM TITLE PAGE
7001 REM
7010 GRAPHICS 0:POKE 559,0
7020 POKE 708,136:POKE 709,26:POKE 710,210:POKE 711,72:POKE 712,52
7030 DL=PEEK(560)+256*PEEK(561):RESTORE 7035
7035 FOR N=1 TO 8:READ DA,DB:POKE DL+DA,DB:NEXT N:DATA 0,0,1,48,3,71,6
,6,15,5,26,6,27,6,28,6
7040 POSITION 3,0:? "MONSTERS' LAIR":?
7050 ? "  USE JOYSTICK 1 TO MANOEUVRE YOUR      EXPLORER  AROUND  EACH
  LAIR  IN"
7060 ? "  SEARCH OF HIDDEN TREASURE — BUT      BEWARE THE MONSTERS  W
HICH PROWL"
7070 ? "  INCESSANTLY  AND WHOSE MOVEMENTS            CANNOT BE ANTICIP
ATED"
7075 ? :? :?
7080 ? "RADAR WILL ASSIST IN YOUR QUEST  BUT  THE TREASURE WILL BE REP
OSITIONED AT"
7090 ? "INTERVALS OF TIME  -  IF YOUR ENERGY  BECOMES LOW, HEAD FOR  T
HE PULSATING"
7095 ? "ENERG" POD- BUT WATCH THOSE MONSTERS"
7100 ? :? "     SCORES ARE BASED ON ENERGY              USED AND ON TI
ME TAKEN"
7110 POSITION 21,20:? "diff level  select":POSITION 1,21:? "initialise
   start";
7115 POKE 559,34
7120 IF PEEK(53279)=7 THEN 7120
7130 POSITION 21,20:? "                 ";
7140 FOR N=1 TO 20:IF PEEK(53279)=6 THEN POP :GOTO 7200
7150 NEXT N
7160 IF PEEK(53279)=5 THEN DIFF=1-DIFF
7170 POSITION 27,20:IF DIFF THEN ? "novice";
7180 IF  NOT DIFF THEN ? "expert";
7190 GOTO 7140
7200 POSITION 1,21:? "initialising ";CHR$(145);" min"
7210 FOR N=1 TO 10:POKE 711,72-PEEK(711):Z=2^2:NEXT N
7250 RETURN
8000 REM GAME OVER
8010 A=USR(1546):GRAPHICS 0:POKE 708,138:POKE 709,186:POKE 710,20:POKE
 711,74:POKE 712,20:POKE 752,1
8020 DL=PEEK(560)+256*PEEK(561)
8030 POKE DL,0:POKE DL+3,71:POKE DL+6,6:FOR N=7 TO 24:POKE DL+N,6:NEXT
 N:POKE DL+28,6
8040 POSITION 3,0:? "MONSTERS' LAIR":POSITION 3,4:? "game concluded"
8042 POSITION 24,1:IF DIFF THEN ? "novice level":GOTO 8050
8045 ? "expert level"
8050 FOR LAIR=1 TO 4:POSITION 4,LAIR+2:? "lair ";CHR$(LAIR+144);"   ";
SCORE(LAIR):SOUND LAIR-1,LAIR*50,10,5
8052 A=2^2^2^2:NEXT LAIR:A=2^2^2^2^2^2:FOR N=0 TO 3:SOUND N,0,0,0:NEXT
 N
8055 FOR N=1 TO 4:ENERGY=ENERGY+ENERGY(N):TIME=TIME+TIME(N):NEXT N:MIN
S=INT(TIME/60):SECS=TIME-MINS*60
8060 ? :? " energy used   ";ENERGY
8070 ? " time  taken  ";MINS;"'";SECS;CHR$(34)
8100 POSITION 9,11:? "OPTION  TO PLAY AGAIN":POSITION 9,12:? "SELECT F
OR DIFFICULTY"
8110 IF PEEK(53279)>5 THEN 8110
8140 FOR N=1 TO 15:IF PEEK(53279)=3 THEN POP :GOTO 8200
8150 NEXT N
8160 IF PEEK(53279)=5 THEN DIFF=1-DIFF
8170 POSITION 7,13:IF DIFF THEN ? "novice";
8180 IF  NOT DIFF THEN ? "expert";
8190 GOTO 8140
8200 GOTO 120
```

WARLOCK'S MOUNTAIN



A J Edgington's quest takes you into Zeroth's mountain to recover the stolen spellbook and fight assorted nasties.

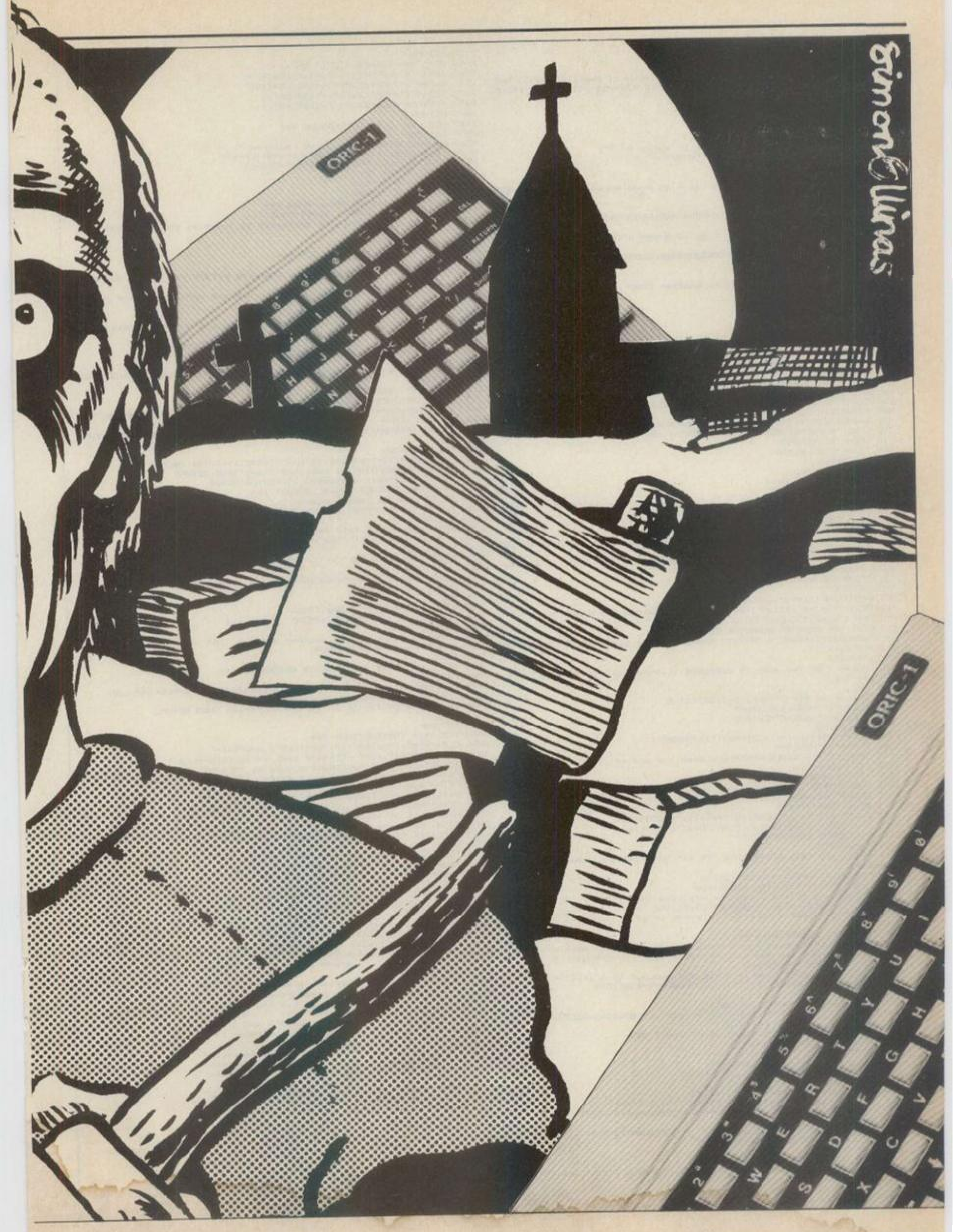
CLIMB THE MOUNTAIN and recover the stolen spellbook in this game, Warlock's Mountain, for the 48K Oric. Instructions are included in the program but the theme is as follows:

The player's task is to recover a spellbook stolen by the warlock which can be found on the top of five floors. These floors consist of stone passageways and caverns which contain treasure and which shift about inside the mountain.

You start in the middle floor, and leave from one of the corners and are able to move floors by falling into traps or using the Enchanted Elevator which appears occasionally. Naturally, you cannot escape until you have found the spellbook in one of the caverns. It is not an easy game to beat.

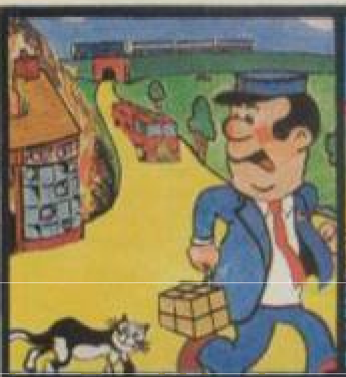
```
5 R=RND(RND(1)*-65535)
10 CLS:INK6:PAPER4
20 DIMT(4,29),TN(9),TP$(9),M$(9)
30 PLOT7,1,CHR$(10)+"The Warlock's Mountain"
40 PLOT7,2,CHR$(10)+"The Warlock's Mountain"
50 DATA255,255,160,255,255
60 DATA Horror,Ambushers,Escape,Hideous Monsters,the WARLOCK's Labo
ratory
70 TR=1000
80 DATA Amberstones,minotaur,Bags of sovereigns,dragon,Crystals,yeh
ti,Diamonds
90 DATA troll,Emeralds,stinging jelly,Gold pieces,yellow mold,Opals
,tiger
100 DATA Rubies,lion,Sapphires,griffon,Pearls,goblin
140 FORX=0TO4:READT(X,0):T(X,1)=T(X,0):T(X,2)=160:T((,3)=T(X,0):T(X
,4)=T(X,0)
150 NEXT
160 FORX=0TO4:FORY=0TO4:FORI=0TO5:T(X,Y+5*I)=T(X,Y):NEXT I,Y,X
170 T(1,6)=244:T(3,6)=244:T(1,8)=244:T(3,8)=244
180 T(2,11)=255:T(2,10)=255:T(3,17)=255:T(4,17)=255:T(2,23)=255:T(2
,24)=255
190 T(0,27)=255:T(1,27)=255
200 FORL=0TO4:READLV$(L):NEXT
210 FORL=0TO9:READ TP$(L),M$(L):NEXTL
220 EX=INT(RND(1)*8)
230 DIME(7):E(0)=48284:E(1)=48362:E(2)=48396:E(3)=48314:E(4)=48962:
E(5)=49074
240 E(6)=48996:E(7)=49044
250 GOSUB4000:LI=-1  ' DISPLAY INSTRUCTIONS
290 GOSUB300:GOTO330
300 CLS:FORS=48282TO48316
310 FORD=STOS+760STEP40
320 POKED,126:NEXTD:NEXTS
325 RETURN
330 P=48774:LV=0:CT=0:PW=INT(RND(1)*21+10):FIGHT=2800
335 C=0:GOSUB340:GOTO 384
340 ST=0:M=48364:GOSUB2000
350 M=48394:GOSUB2000
360 M=48964:GOSUB2000
370 M=48994:GOSUB2000
375 ST=0:M=P:GOSUB2000
377 ST=9
380 GOSUB2100
383 POKEP,164:RETURN
384 PRINT" Press N,S,W or E to change direction just before you rea
ch a junction"
385 IFPEEK(616)>5THENGOSUB2100
386 I=1
390 PRINT"Which way ( N,S,E or W )";:GETD$
395 GOSUB2100
400 GOSUB2200
405 IFC<0THEN700
406 IFC=27THENC=-1
410 PK=PEEK(P+I):V=INT(RND(1)*10)
415 M=P+3*I:P1=P+I:S=0
420 IFP=E(EX)ANDLV=0ANDSB=1THEN1500
430 CT=INT(RND(1)*10)-4:IFCT=-1THENCT=1 ELSECT=CT+(CT<0)*CT
440 IFPK<33THENP=P-I:I=0-I:POKEP-I,160:POKEP,164
460 IFPK=126THENGOSUB2000:CT=1:GOTO400
470 WAIT20:D$=KEY$
480 IFPK=255THENI=0-I:GOTO530
490 IFRND(1)*50>=49 THEN GOSUB800
500 IFRND(1)*200>=199THEN550
510 IFLV=2ANDRND(1)*SB>=.99THENGOSUB2640:PRINT"Lucky !!":WAIT300:GO
SUB2100
520 IFSB*C>25THEN550
530 POKEP,160:P=P+1:POKEP,164:GOTO400
```

(listing continued on page 118)


ORIC-1
ORIC-1

(listing continued from page 116)

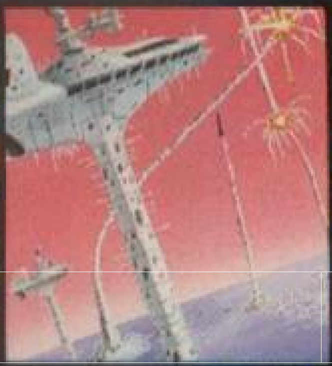
```
550 PRINT"   A Trap to catch unwary travellers.":WAIT200:POKEP,160
560 P1%=(P-48364)/200:P2%=P-48364-200*P1%:P2%=P2%-INT(P2%/40)*40:P3
%=P2%/5
570 P=48364+P3%*5+P1%*200:GOTO705
599 REM  *** CHANGE FLOOR ***
600 POKEP+I,189:GOSUB2100
610 PRINT" The Enchanted Elevator."
620 PRINT"Up a floor,down a floor or carry on ?";
630 GETA$:IFA$="C"THENGOSUB2100:GOTO2010
635 C=0:CT=0:ST=0
640 IFA$="U"THEN670
650 IFLV=-2THENPRINT:PRINT"You can't go down anymore ":WAIT300:GOTO
2010
655 GOSUB300
660 LV=LV-1:P=P+3*I:IFLV=0THENGOSUB340ELSEGOSUB375
665 RETURN
670 IFLV=2THENPRINT" You can't go up anymore":WAIT300:GOTO2010
675 GOSUB300
680 LV=LV+1:P=P+3*I:IFLV=0THENGOSUB340ELSEGOSUB375
690 RETURN
700 GOSUB2100:GOTO550
705 PRINT"You dematerialised to another floor.":WAIT300
707 C=0:CT=0:ST=0
710 IFLV=2THENLI=-1
711 IFLV=-2THENLI=1
715 LV=LV+LI
720 GOSUB300
730 IFLV=0THENGOSUB34(ELSEGOSUB375
740 GOSUB2100:GOTO385
799 REM  *** WANDERING MONSTER ***
800 S$=KEY$:GOSUB2100
810 PRINT"There is a "M$(V)" wandering about ahead.Do you wish to a
pproach it,";
820 PRINT"sneak up on it,withdraw or cast treasure ?";:GETA$
825 GOSUB2100
830 W=INT((ABS(LV)+1)*10*RND(1))+20*RND(1)
840 IFA$="W"THENIFPEEK(P-I)=160THENI=-I:RETURN
850 IFA$="A"THEN900
853 IFA$="C"THEN1600
855 GOSUB2800
870 IFW<20THEN950
880 W=INT(RND(1)*10)+1
885 PW=PW-W
890 PRINT"You survived,but are wounded ";:IFPW<=0THENPRINT"fatally"
:GOTO3000
893 IFW<6THENPRINT"slightly"ELSEPRINT"badly"
895 WAIT300:GOTO2100
900 IFRND(1)>.6THENPRINT"He's friendly;you may pass":WAIT300:GOTO21
00
910 PRINT"It's one of the Warlock's pets,and    he's not in a very
good mood;"
920 GOSUB2800:W=INT(RND(1)*10)
930 GOTO885
950 W=INT(RND(1)*10):GOSUB2100
960 PRINT"You've killed the "M$(V)" and gained his power."
970 PW=PW+W:WAIT300:GOTO2100
999 REM  *** MONSTER GUARDING TREASURE ***
1000 GOSUB2100:PRINT"A "M$(V)" appears to be guarding the treasure
in this cavern"
1005 A$=KEY$
1010 PRINT"  Do you wish to approach it,sneak up and attack it, or
retreat ?";
1015 S=0
1020 GET A$:IF A$="R"THENI=0-I:GOTO2100
1030 IFA$="S"THENS=15ELSES=9
1040 IFA$<>"A"ANDS=0THEN1020
1045 GOSUB2100
1050 W=INT((ABS(LV)+1)*10*RND(1))+20*RND(1)
1060 IFA$="A"THEN1400
1065 IFRND(1)*10<5THENPRINT"He's seen you and is pretty angry.":S=7
1070 IFW<STHEN1200
1080 IFW>55THEN1140
1085 GOSUB FIGHT
1090 PRINT"You have killed the "M$(V)" but it has wounded you ";
1095 W=INT(RND(1)*10)
1100 PW=PW-W:IFPW<=0THENPRINT"fatally":GOTO3000
1110 IFW>5THENPRINT"badly" ELSE PRINT"slightly"
1120 S=0:GOSUB 2500:GOTO2100
1200 GOSUB2800
1210 PRINT"You have killed the "M$(V)" and absorbed some of his mag
ic powers"
1220 PW=PW+INT(RND(1)*10):GOTO1120
1400 A=INT(RND(1)*10):IFA<6THEN1450
1410 PRINT"He's friendly and you may take the ";
1420 PRINT"treasure of ";:GOSUB2520:RETURN
1450 PRINT"He doesn't look very pleased to see   you and, yes,";:GO
TO1085
1499 REM  *** PLAYER WINS ***
1500 CLS:PRINT"You have found the exit and escaped.  Well done !"
1505 PRINT" I bet you can't do it again !!"
1510 K$="captured":GOTO3050
1600 GOSUB2100:PRINT" Cast : a,b,c,d,f,g,o,p,r or s";:GETA$
1610 FORN=0TO9:IFA$=LEFT$(TP$(N),1)THENA$=TP$(N):G=N
1615 NEXTN
1620 IFLEN(A$)=1THENPRINT:GOTO855
1630 IFTN(G)<10THENPRINT:PRINT"No effect...":WAIT300:GOTO855
1635 PRINT
1640 PRINT"The "M$(V)" has vanished.":WAIT 300
1650 TN(G)=INT(RND(1)*TN(G))
1660 GOTO2100
1999 REM  *** DRAW A NEW CAVE ***
2000 IF RND(1)*20>=19 AND ST>0 THEN600
2005 GOSUB3500
2010 FORN=0TO4:POKEM-82+N,T(0,N+CT*5)
2020 POKEM-42+N,T(1,N+CT*5):POKEM-2+N,T(2,N+CT*5)
2030 POKEM+38+N,T(3,N+CT*5):POKEM+78+N,T(4,N+CT*5):NEXTN
2040 PLAY1,0,0,0
2050 FORS=1000TO500STEP-20:SOUND1,S,9:NEXTS:WA~T5:PLAY0,0,0,0
2060 IFCT=1THEN CT=0:GOSUB TREASURE
2070 C=C+1:RETURN
2099 REM  *** CLEAR TOP SIX ROWS ***
2100 PRINTCHR$(30);:FORN=1TO6:PRINTCHR$(14):NEXT:PRINTCHR$(30);
2110 PRINT" Level of "LV$(LV+2)
2115 IFS<>0THENRETURN
2120 PRINT"Power now is "PW
2130 RETURN
2199 REM  *** CHANGE DIRECTION ***
2200 IFD$="N"ANDPEEK(P-40)=160THENI=-40
2210 IFD$="S"ANDPEEK(P+40)=160THENI=40
2220 IFD$="E"ANDPEEK(P+1)=160THENI=1
2230 IFD$="W"ANDPEEK(P-1)=160THENI=-1
2240 RETURN
2499 REM  *** ADD TO TREASURE ***
2500 WAIT300
2510 GOSUB2100:PRINT"You have captured ";
2520 JW=INT(RND(1)*50)+10:TP=INT(RND(1)*10)
2525 IFJW>50 AND LV=2 AND SB=0 THEN2600
2530 PRINTJW;TP$(TP)
2540 TN(TP)=TN(TP)+JW
2550 WAIT300:GOTO2100
2599 REM  *** CAPTURE SPELL-BOOK ***
2600 PRINT"the Warlock's spell-book.";
2610 SB=1:PRINT"It would be advisable to leave as soon as possible
now!"
2620 WAIT800:GOTO2100
2639 REM  *** CONFRONT WARLOCK ***
2640 GOSUB2100:TT=0
2650 PRINT"Zeroth the Warlock is standing before you and he wants h
is spellbook";
2660 PRINT" back;  you can give it to him and hope to    find anoth
er copy";
2670 PRINT" or ...":WAIT900:S=0:GOSUB2100
2680 PRINT"cast all of your treasure at him and  hope he vanishes o
r fight him";
2690 PRINT" if you  are feeling powerful.":A$=KEY$:WAIT900
2700 PRINT"Choose G,C ur F";:GETA$
2705 GOSUB2100
2710 IFA$="G"THENGOSUB2100:PRINT"He's disappeared !":WAIT400:GOSUB2
100:RETURN
2720 IFA$="C"THEN2760
2730 IFA$<>"F"THENGOSUB2100:GOTO2700
2740 IFPW<15THENPRINT"You don't have a chance !":GOSUB2810:PRINT"He
 killed you":PW=0
2745 IFPW>14ANDRND(1)>.4THENPRINT"50-50 !":GOSUB2810:IFRND(1)>.4THE
NRETURN
2750 POP:GOTO3000
2760 FORN=0TO9:TT=TT+TN(N):TN(N)=INT(RND(1)*TN(N)):NEXTN
2770 IFTT>250THENPRINT"He vanished !":WAIT400:RETURN
2780 PRINT"No effect whatsoever.":POP:GOTO3000
2799 REM  *** CONDUCT MORTAL COMBAT ***
2800 PRINT" mortal combat ensues..."
2810 FOR N=1TO40 :POKEP,170:WAIT9:POKEP,164:WAIT8:NEXT N
2820 RETURN
2999 REM  *** END OF TRIP ***
3000 WAIT300:CLS:PRINT" You're dead !":WAIT200
3010 K$="lost"
3050 PRINT"Treasure "K$" :-":PRINT
3055 Y=PEEK(616)
3060 FORN=0TO9:IFTN(N)=0THEN3080
3070 PRINT TN(N);TP$(N)
3080 NEXTN
3083 IFSB=1THENPRINT" 1 Spellbook"
3085 IFPEEK(616)=YTHENPRINT:PRINT" Not a lot !"
3087 PRINT:PRINT
3090 INPUT "Would you like another attempt ";A$
3100 IFLEFT$(A$,1)="Y"THENRUN
3110 END
3499 REM  *** CHECK FOR BLOCKED ENTRANCES ***
3500 P9=P+8*I
3510 P1=PEEK(P9+3):P2=PEEK(P9-3):P3=PEEK(P9+120):P4=PEEK(P9-120)
3520 IFP1=160ORP2=160ORP3=160ORP4=160THENRETURN
3530 IF P1=126 OR P2=126 OR P3=126 OR P4=126 THEN RETURN
3540 CT=0
3570 RETURN
3999 REM  *** INSTRUCTIONS ***
4000 CLS:PRINT:PRINTSPC(10)"Warlock's mountain"
4010 PRINT:PRINT" Your ultimate task is to recover a "
4020 PRINT"copy of a spellbook stolen by Zeroth"
4030 PRINT"the warlock from your master 137 years";
4040 PRINT"ago.Many others have tried,but failed.";
4050 PRINT" Zeroth lives inside a mountain which"
4060 PRINT"has 5 levels of passages and caverns"
4070 PRINT"all of which shift about.There are "
4080 PRINT"monsters guarding all of the treasure"
4090 PRINT"in the caverns,but they might be "
4100 PRINT"friendly and let you take it.If not"
4110 PRINT"you will have to f~ght them for it,"
4120 PRINT"possibly getting wounded or maybe "
4130 PRINT"gaining power from the experience."
4140 PRINT" The spellbook is to be found on the"
4150 PRINT"top level of the Warlock's laboratory"
4160 PRINT"and the exit in a corner of the floor"
4170 PRINT"of Escape.Should you meet the warlock"
4180 PRINT"take great care,if you decide to give"
4190 PRINT"him the book back he will go away,but"
4200 PRINT"you will have to find another copy"
4210 PRINT"before you can escape."
4220 PRINT:PRINT"        press a key to continue..."
4230 A$=KEY$:GETA$:CLS
4300 PRINT:PRINTSPC(10)"Warlock's mountain":PRINT
4310 PRINT" Collect as much treasure as possible"
4320 PRINT"on your journey as it has magical"
4330 PRINT"properties i.e. when~cast at monsters"
4340 PRINT"it can make them disappear, and if it"
4350 PRINT"does you can always retrieve some of"
4360 PRINT"it from the ground."
4370 PRINT" On encountering an obstacle you will"
4380 PRINT"be given a choice of possible courses"
4390 PRINT"of action; just use the initial letter";
4400 PRINT"to determine the one you choose."
4410 PRINT" When dealing with treasure guardians"
4420 PRINT"and wandering animals you can withdraw";
4430 PRINT"before they see you, or approach them"
4440 PRINT"or sneak up on them,maybe causing a"
4470 PRINT"fight,usually ending in their death"
4480 PRINT"and you being wounded,perhaps fatally,";
4500 PRINT"if your power is low.Sneaking up on "
4510 PRINT"them however always causes a fight,but";
4520 PRINT"you have a much better chance of "
4530 PRINT"finishing it unharmed and absorbing"
4540 PRINT"some of your adversaries power."
4550 PRINT:PRINT"        press a key to start..."
4580 A$=KEY$:GETA$:RETURN
```



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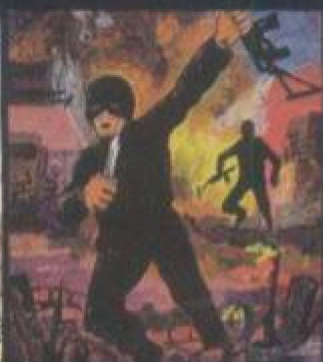
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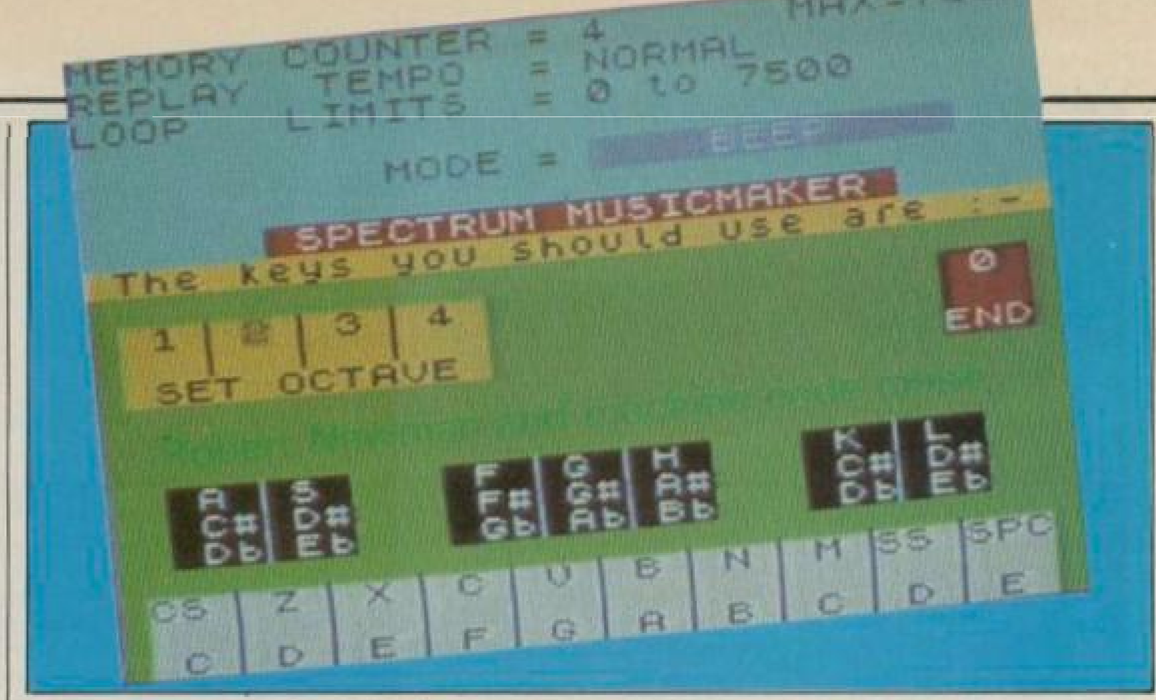
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MUSIC MAKER

IN COMPARISON WITH the other features of the ZX Spectrum computer, its sound capabilities are often underused. When compared to the facilities offered by other micros the single channel Beep of the Spectrum does seem rather tame.

However, it is worthwhile to learn how to make the most of the Beep command, since the inclusion of sound or music in your programs can add a great deal to their impact.

For anything other than very short tunes, the amount of work involved is prohibitive. It would be very much easier if you could actually play the tune into the memory of the computer, using the Spectrum keyboard in the same way as a piano keyboard. The Spectrum then becomes a musical instrument upon which you can compose music, storing it as you play, and then sit back and listen as the computer replays it for you.

Once you are satisfied, you could save the stored music in the memory to tape so that it could be included in another program.

It was with this idea in mind that I wrote the program called Spectrum Musicmaker in listing 1. This program runs on a 48K Spectrum, and allows you to play music over a range of four and a half octaves. The bottom two rows of keys operate like a piano keyboard, with Caps Shift to Space playing white notes, and A to L giving the black notes. The numberr keys 1 to 4 are used to change the pitch of the keys in one octave steps.

If you wish to store your music as it is being played, it is put into memory between addresses 35000 and 65000, which can hold up to 15000 notes — at least 30 minutes of music. Each note that you play, or each pause between notes, is stored as two bytes in the memory.

The first byte takes values from 0 to 53, where a value of 0 means that no key was being pressed, and values from 1 to 53 correspond to Beeps of pitch -12 to 40. The second bytes tells how long the note — or rest — lasts for, and a value of 40 corresponds to about 1 second. You can stop playing at any time and listen to a playback of your music, either at normal speed or at a faster or slower tempo, and then carry on playing by adding to the end of recording over what you have already stored.

In addition, the computer can be made to play back in a loop — replaying the same piece over and over again. This could be useful if you have another musical instrument and use the Spectrum to set up a backing track to which you can play an accompaniment.

All or part of the music memory can be saved to tape, and later reloaded to be replayed either by the "musicmaker" program, or by a small subroutine — listing 5 desribed later in this article — which you can include in your own programs.

The musicmaker program uses a machine code routine when the keyboard is being played as a musical instrument. the routine is disassembled in listing 4. The machine code scans the keyboard, plays the correct note if a key is being pressed, counts how long a key is held down, stores the note and its length in memory, updates the memory counter displayed on the TV screen and indicates what octave you are currently playing in, changing this if one of the keys 1 to 4 are pressed.

The usual Break key is disabled while the machine code is running, and you return to the main program by pressing key 0.

To make a copy of the program, you should first type in the Basic program in listing 1. Do not Run the program yet, because it needs the machine code which you have not yet entered. Save the Basic program with the command:

```
SAVE "musicmaker" LINE 70
```

After Verifying the program you can enter the machine code. Erase the main program with New, and then type in and Run the loader program in listing 2. Input the machine code from the dump in listing 3. When you have finished, the machine code should be Saved after the main program on your tape with the command:

```
SAVE "beepcode" CODE 34273,308
```

You can now rewind the tape and Load musicmaker. The program will auto-run and load the machine code. Before the screen displaying the main menu of options appears, there will be a short delay while the program clears the music memory and Pokes data for the machine code routine. This delay only occurs when the program is Run for the first time.

If you accidentally break out of the program back to Basic without having saved your music to tape, you can simply type RUN to restart without losing the contents of the music memory.

The memory counter at the top of the screen shows you what part of the memory you are recording into or replaying from. If you are using the program to store a tune which you want to be able to use in one of your own programs, you will need to make a note of its value at the beginning and end of your tune.

You can then select the Save to tape option in the main menu and tell the program that you only want to save part of the memory. When you have input the start and end counter values of your tune, the program will tell you the actual memory address from where your code is stored, and the number of bytes, as it saves your code.

In your own program you are unlikely to want to store the music code in these same memory locations. For example, if your Basic program is longer than the musicmaker Basic program, you might have to store the music code at a higher memory address. Since the music code is just data, it can easily be relocated to any address. In your program you simply load it in using:

```
LOAD "music" CODE new start address, no. of bytes
```

Before doing this, you will of course need to have reset RAMtop to a suitable value using the Clear command so that the music code cannot be overwritten by the Basic system. In your program, the tune can be replayed by using the subroutine in listing 5. Before calling it, you should assign variables M$ and NB. M$ is the start address of the music code, and NB is the number of bytes.

The volume from the Spectrum's built-in speaker is not very loud. However, with some cassette recorders you can amplify the sound as follows. Connect the Mic lead from computer to recorder, and disconnect the Ear lead. Remove any tape from the recorder, and then press Play. You should then find that the sound from the Spectrum is amplified through the loudspeaker of the recorder.

If you would prefer to save yourself the trouble of typing in the program and machine code, I can supply you with a cassette, price £3 from 47 Wellingborough Road, Broughton, Kettering, Northants.

```
MEMORY  COUNTER  = 0                MAX=7500
REPLAY   TEMPO   = NORMAL
LOOP    LIMITS   = 0 to 7500
          MODE = STANDBY
     SPECTRUM MUSICMAKER
 The keys you should use are :-
C = Set counter.
T = Set replay tempo.
L = Set loop limits.
Z = Beep.
B = Beep and store.
R = Replay music.
P = Loop replay.
S = Save music to tape.
J = Load music from tape.
0 = End program.
```

Listing 2. Machine code loader program.

```
10 CLEAR 33999
20 FOR j=34273 TO 34580
30 PRINT j;" ";
40 INPUT n: POKE j,n
50 PRINT n
60 NEXT j
70 SAVE "beepcode"CODE 34273,308
```

Listing 3. Machine code dump.

Bytes from 34273 to 34580

247	221	33	208	132	175	50	210	132	50
211	132	50	212	132	50	214	132	221	54
1	12	62	2	205	1	22	205	1	134
251	201	1	254	239	237	120	203	71	200
17	0	1	6	247	205	249	134	123	254
0	40	41	254	5	40	37	22	0	32
221	132	25	126	50	209	132	197	33	33
89	6	12	62	48	119	35	16	252	175
190	3	29	32	251	95	33	31	89	25
62	176	119	193	17	0	1	6	253	205
249	134	6	191	205	249	134	6	254	205
249	134	6	127	205	249	134	22	0	33
226	132	25	126	254	0	40	3	221	134
1	50	208	132	221	203	5	70	40	93
221	190	2	32	16	221	52	3	62	255
221	190	3	32	78	62	215	132	58	210
132	119	35	58	2.1	132	119	35	34	215
132	58	208	132	56	210	132	221	54	3
1	237	91	217	132	167	237	82	56	5
221	54	4	1	[illegible]	221	52	6	221	203
6	70	32	29	62	22	215	175	215	62
17	215	237	75	219	132	3	237	67	219
132	205	27	26	62	32	215	62	32	215
62	32	215	58	208	132	254	0	32	12
6	18	14	255	17	32	253	16	249	195
1	134	7	7	95	22	0	33	247	132
25	78	35	70	35	94	35	86	197	225
221	229	205	181	3	221	225	195	1	134
237	120	6	5	15	56	1	90	20	16
249	201	175	33	184	136	6	118	14	255
119	35	13	32	251	16	247	201		

Listing 5.

```
9900 REM This subroutine can be
9901 REM used to replay music
9902 REM code saved from the
9903 REM "musicmaker" program.
9904 REM
9905 REM Before calling it, you
9906 REM must assign variables
9907 REM MS and NB :-
9908 REM
9909 REM MS = address of first
9910 REM byte of music code.
9911 REM
9912 REM NB = number of bytes.
9913 REM
9914 REM Remember to CLEAR
9915 REM RAMTOP to a suitable
9916 REM value before loading
9917 REM the music code
9918 REM
9919 REM To remove the pauses
9920 REM between notes, take out
9921 REM line 9920
9922 REM
9923 REM ***********************
9930 FOR j=MS TO MS+NB-2 STEP 2
9910 IF PEEK j THEN  BEEP PEEK (j+1)*.025,PEEK j-12: GO TO 9930
9920 IF PEEK (j+1)<20 THEN  PAUSE PEEK (j+1)
9930 NEXT j
9940 RETURN
9950 REM ***********************
```

Listing 4. Disassembled machine code.

```
ORG   34000
NOTE  DEFB 0
OCTAV DEFB 0
LASTN DEFB 0
TIME  DEFB 0
MFLAG DEFB 0
MODE  DEFB 0
BOOLY DEFB 0
MEMRY DEFW 0
MEND  DEFW 0
COUNT DEFW 0

OVALS DEFB 0
      DEFB 0
      DEFB 12
      DEFB 24
      DEFB 36
KVALS DEFB 0
      DEFB 2
      DEFB 4
      DEFB 0
      DEFB 7
      DEFB 9
      DEFB 0
      DEFB 16
      DEFB 14
      DEFB 0
      DEFB 11
      DEFB 1
      DEFB 3
      DEFB 5
      DEFB 6
      DEFB 8
      DEFB 17
      DEFB 15
      DEFB 13
      DEFB 12
      DEFB 10
BVALS DEFS 216

ORG 34273

START DI
      LD    IX,NOTE
      XOR   A
      LD    (LASTN),A
      LD    (TIME),A
      LD    (MFLAG),A
      LD    (BOOLY),A
      LD    (IX+1),12
      LD    A,2
      CALL  1601H
      CALL  MAIN
      EI
      RET

MAIN  LD    BC,0EFFEH
      IN    A,(C)
      BIT   0,A
      RET   Z
      LD    DE,100H
```

(listing continued on page 124)

Listing 1. Program: musicmaker.

```
10 REM ************************
20 REM * Spectrum musicmaker *
30 REM * (C) R. Newman 1983 *
40 REM ************************
50 GO TO 230
60 REM auto-run entry point
70 CLEAR 33999
80 BORDER 4: PAPER 6: INK 0: CLS
90 PRINT AT 5,0;"Please wait for the machine code" TAB 12;"to load."
100 LOAD "beepcode"CODE
105 PRINT '"PLEASE WAIT A FEW MOMENTS LONGER"
110 RANDOMIZE USR 34565
120 RESTORE
130 FOR j=34013 TO 34038: READ n: POKE j,n: NEXT j
140 DATA 0,0,12,24,36,0,2,4,0,7,9,0,16,14,0,11,1,3,5,6,8,17,15,13,12,10
150 FOR j=34039 TO 34251 STEP 4
160 READ n: POKE j,FN l(n): POKE j+1,FN h(n)
170 IF n THEN  LET n=INT ((10000/n)+.5)
180 POKE j+2,FN l(n): POKE j+3,FN h(n)
190 NEXT j
200 DATA 0,3320,3130,2950,2780,2620,2475,2330,2200,2075,1950,1850,1740,1640,154
5,1460,1375,1290,1225,1155,1085,1024,965,910,855
210 DATA 805,760,715,670,632,596,565,530,495,466,438,412,388,365,342,322,302,28
5,265,250,233,218,206,192,180,167,156,146,136
220 REM *** initialisation ****
230 DEF FN a(x)=mstart+4*x
240 DEF FN c(x)=INT ((x-mstart)/4)
250 DEF FN h(x)=INT (x/256)
260 DEF FN l(x)=x-256*FN h(x)
270 DEF FN p(x)=PEEK x+256*PEEK (x+1)
280 DIM t$(3,6): DIM m$(7,12)
290 LET a$=""
300 LET mstart=35000
310 LET mend=65004
320 LET mcode=34273
330 LET lms=mstart
340 LET lme=mend
350 LET c=0
360 LET cmax=7500
370 LET lolim=0
380 LET hilim=cmax
390 LET t=1
400 RESTORE 430
410 FOR j=1 TO 7: READ m$(j): NEXT j
420 FOR j=1 TO 3: READ t$(j): NEXT j
430 DATA "   STANDBY","      BEEP","BEEP & STORE","    REPLAY","LOOP REPLAY","  TA
PE SAVE","  TAPE LOAD"
440 DATA "  SLOW","NORMAL","  FAST"
500 REM * display main screen *
510 BORDER 3: PAPER 5: INK 0: CLS
520 PRINT "MEMORY COUNTER = 0";TAB 24;"MAX=7500"
530 PRINT "REPLAY  TEMPO  = NORMAL"
540 PRINT "LOOP   LIMITS  = 0 to 7500"
550 PRINT 'TAB 10;"MODE = "; FLASH 1;m$(1)
560 PRINT AT 6,6; PAPER 2; INK 7;" SPECTRUM MUSICMAKER "
570 PRINT ' PAPER 6;" The keys you should use are :- "
580 GO SUB 5200
1000 REM **** main loop ********
1010 POKE 23658,8
1020 INPUT "Your choice? ";a$
1030 IF a$="0" THEN  STOP
1040 IF a$="C" THEN  GO SUB 1500
1050 IF a$="T" THEN  GO SUB 1600
1060 IF a$="L" THEN  GO SUB 1800
1070 IF a$="Z" THEN  GO SUB 2000
1080 IF a$="B" THEN  GO SUB 3000
1090 IF a$="R" THEN  GO SUB 4000
1100 IF a$="P" THEN  GO SUB 6000
1110 IF a$="S" THEN  GO SUB 7000
1120 IF a$="J" THEN  GO SUB 7500
1130 GO TO 1010
1140 REM ************************
1500 REM *** set counter *******
1510 INPUT "New value for counter? ";c
1520 LET c=INT c: IF c<0 OR c>cmax THEN  GO TO 1510
1530 PRINT AT 0,17;c;"    "
1540 RETURN
1550 REM ************************
1600 REM *** set replay tempo **
1610 GO SUB 8000
1620 PRINT " S for slow tempo."
1630 PRINT '" N for normal tempo."
1640 PRINT '" F for fast tempo."
1650 POKE 23658,8
1660 IF INKEY$<>"S" AND INKEY$<>"N" AND INKEY$<>"F" THEN  GO TO 1660
1670 IF INKEY$="S" THEN  LET t=3: LET z=1
1680 IF INKEY$="N" THEN  LET t=1: LET z=2
1690 IF INKEY$="F" THEN  LET t=.2: LET z=3
1700 PRINT AT 1,17;t$(z)
1710 GO SUB 5200
1720 RETURN
1730 REM ************************
1800 REM ** set loop limits ****
1810 GO SUB 8000
1820 PRINT "Enter new values for loop limits"
1830 INPUT "Low limit? ";n
1840 LET n=INT n: IF n<0 OR n>=cmax THEN  GO TO 1830
1850 LET lolim=n
1860 INPUT "High limit? ";n
1870 LET n=INT n: IF n<=lolim OR n>cmax THEN  GO TO 1860
1880 LET hilim=n
1890 PRINT AT 2,17;lolim;" to ";hilim;"     "
1900 GO SUB 5200
1910 RETURN
1920 REM ************************
2000 REM ****** beep ***********
2010 PRINT AT 4,17; PAPER 1; INK 7; FLASH 1;m$(2)
2020 GO SUB 5000
2030 POKE 34005,0
2040 RANDOMIZE USR mcode
2050 GO SUB 5200
2060 PRINT AT 4,17; FLASH 1;m$(1)
2070 RETURN
2080 REM ************************
3000 REM **** beep and store ***
3010 PRINT AT 4,17; PAPER 6; INK 1; FLASH 1;m$(3)
3020 GO SUB 5000
3030 LET lms=FN a(c)
3040 POKE 34005,1
3050 POKE 34007,FN l(lms)
```

(listing continued on page 124)

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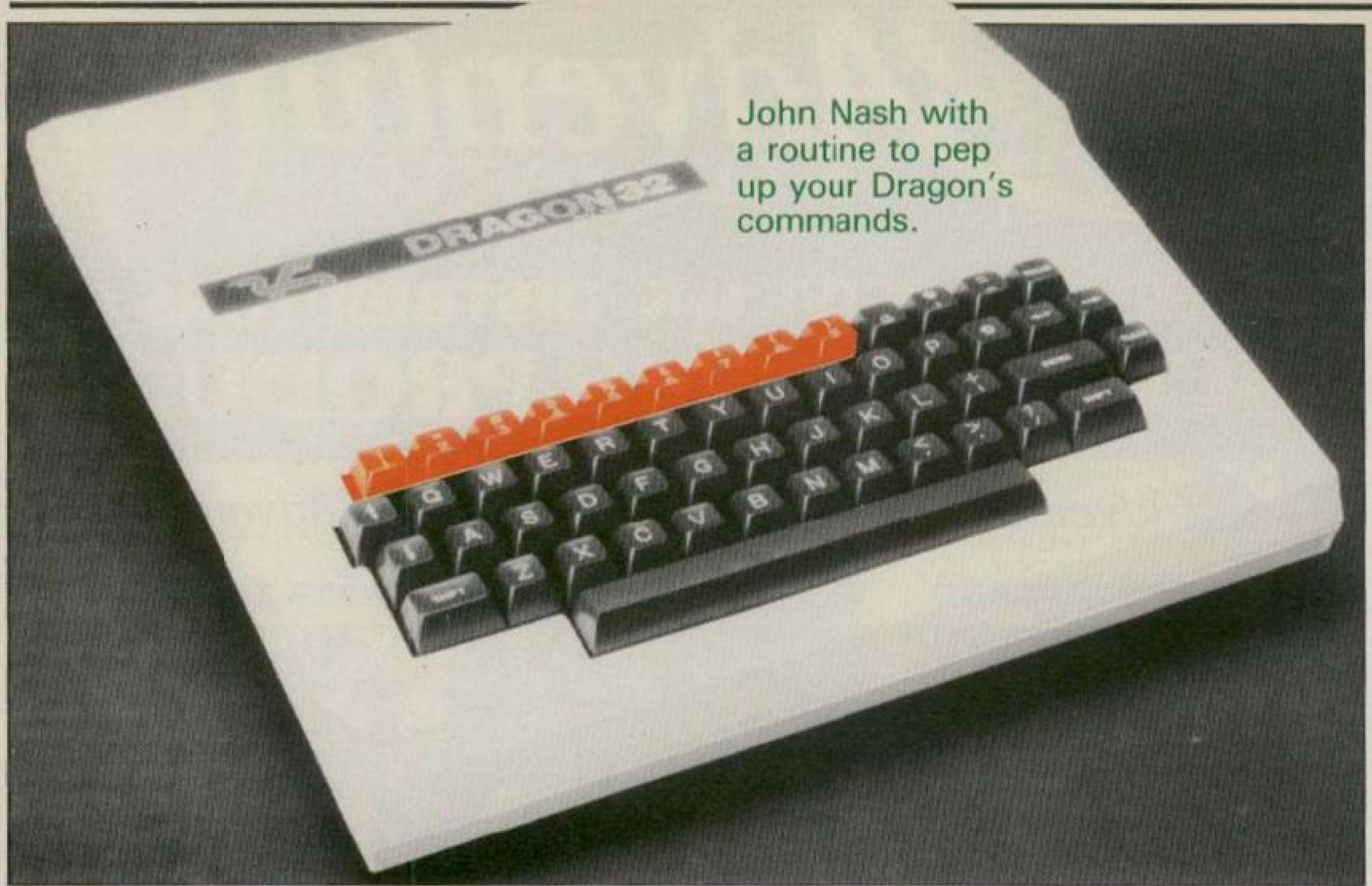
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(listing 1 continued from page 121)

```
3060 POKE 34008,FN h(lme)
3070 POKE 34009,FN l(mend)
3080 POKE 34010,FN h(mend)
3090 POKE 34011,FN l(c)
3100 POKE 34012,FN h(c)
3110 RANDOMIZE USR mcode
3120 LET lme=FN p(34007)
3130 LET c=FN p(34011)
3140 GO SUB 5200
3150 PRINT AT 4,17; FLASH 1;m$(1)
3160 RETURN
3170 REM ************************
4000 REM **** replay music *****
4010 GO SUB 8000
4020 PRINT " L to replay last tune."
4030 PRINT " R replays from counter onwards."
4040 PRINT " C to reset counter,then replay."
4050 POKE 23658,8
4060 IF INKEY$<>"L" AND INKEY$<>"R" AND INKEY$<>"C" THEN  GO TO 4060
4070 LET z$=INKEY$
4080 IF z$="L" THEN  LET ms=lms: LET me=lme: LET c=FN c(lms): GO TO 4110
4090 IF z$="C" THEN  GO SUB 1500
4100 LET ms=FN a(c): LET me=mend
4110 PRINT AT 0,17;c;"   "
4120 GO SUB 4500
4130 PRINT AT 4,17; FLASH 1;m$(4)
4140 PAPER 5: INK 0
4150 GO SUB 6500
4160 GO SUB 5200
4170 PRINT AT 4,17; FLASH 1;m$(1)
4180 RETURN
4190 REM ************************
4500 REM *** replay menu *******
4510 PAPER 2: INK 7: GO SUB 8000
4520 PRINT " A to stop playback."
4530 PRINT '" S for slow tempo."
4540 PRINT '" N for normal tempo."
4550 PRINT '" F for fast tempo."
4560 RETURN
4570 REM ************************
5000 REM **** show piano keys **
5010 PAPER 4: GO SUB 8000
5020 PAPER 6
5030 PRINT AT 9,1;" 1  2  3  4 ";AT 10,1;"                    ";AT 11,1;" SET OCTAVE "
5040 FOR j=0 TO 2
5050 PLOT 31+j*24,103: DRAW 0,-15
5060 NEXT j
5070 PRINT  PAPER 2; INK 7;AT 9,28;" 0 ";AT 10,28;"   ";AT 11,28;"END"
5080 PAPER 0: INK 7
5090 PRINT AT 15,2;" A  S ";AT 15,11;" F  G  H ";AT 15,23;" K  L "
5095 PRINT AT 16,2;" C# D#";AT 16,11;" F# G# A#";AT 16,23;" C# D#"
5100 PRINT AT 17,2;" Db Eb";AT 17,11;" Gb Ab Bb";AT 17,23;" Db Eb"
5105 PLOT 41,32: DRAW 0,24
5110 PLOT 113,32: DRAW 0,24
5115 PLOT 137,32: DRAW 0,24
5120 PLOT 208,32: DRAW 0,24
5125 PAPER 7: INK 0
5130 PRINT AT 19,1;"CS  Z  X  C  V  B  N  M SS SPC"
5135 PRINT AT 20,1;"                              "
5140 PRINT AT 21,1;" C  D  E  F  G  A  B  C  D  E "
5145 FOR j=0 TO 8
5150 PLOT 31+j*24,0: DRAW 0,24
5155 NEXT j
5160 POKE 22821,176
5165 PAPER 5
5170 RETURN
5180 REM ************************
5200 REM **** show main menu ***
5210 PAPER 5: INK 0
5220 GO SUB 8000
5230 PRINT " C = Set counter."
5240 PRINT " T = Set replay tempo."
5250 PRINT " L = set loop limits."
5260 PRINT " Z = Beep."
5270 PRINT " B = Beep and store."
5280 PRINT " R = Replay music."
5290 PRINT " P = Loop replay."
5300 PRINT " S = Save music to tape."
5310 PRINT " J = Load music from tape."
5320 PRINT " O = End program."
5330 RETURN
5340 REM ************************
6000 REM **** loop replay ******
6010 GO SUB 4500
6020 PRINT AT 4,17; FLASH 1;m$(5)
6030 PAPER 5: INK 0
6040 LET ms=FN a(lolim): LET me=FN a(hilim)+2
6050 LET c=lolim: PRINT AT 0,17;c;"   "
6060 GO SUB 6500: IF q$<>"A" THEN  GO TO 6050
6070 GO SUB 5200
6080 PRINT AT 4,17; FLASH 1;m$(1)
6090 RETURN
6100 REM ************************
6500 REM ** play from ms to me *
6510 LET a=ms: LET b=1: LET q$="": LET s=t*.025
6520 IF PEEK a THEN  BEEP PEEK (a+1)*s,PEEK a-13: GO TO 6540
6530 IF PEEK (a+1)>20 THEN  PAUSE PEEK (a+1)*t+1
6540 IF INKEY$="" THEN  GO TO 6600
6550 LET q$=INKEY$
6560 IF q$="A" THEN  RETURN
6570 IF q$="S" THEN  LET s=.075: LET t=3: PRINT AT 1,17;t$(1)
6580 IF q$="N" THEN  LET s=.025: LET t=1: PRINT AT 1,17;t$(2)
6590 IF q$="F" THEN  LET s=.005: LET t=.2: PRINT AT 1,17;t$(3)
6600 LET a=a+2: IF a=me THEN  RETURN
6610 LET b=NOT b: IF b THEN  LET c=c+1: PRINT AT 0,17;c
6620 GO TO 6520
6630 REM ************************
7000 REM **** tape save ********
7010 PAPER 1: INK 7: GO SUB 8000
7020 PRINT " A to save all of music memory."
7030 PRINT '" P to save part of memory."
7040 POKE 23658,8
7050 IF INKEY$<>"A" AND INKEY$<>"P" THEN  GO TO 7050
7060 IF INKEY$="A" THEN  LET cst=mstart: LET cend=mend+3: GO TO 7150
7070 PRINT '"From ";
7080 INPUT "Low value for counter? ";n
7090 LET n=INT n: IF n<0 OR n>=cmax THEN  GO TO 7080
7100 PRINT n;" to ";
7110 INPUT "High value for counter? ";z
7120 LET z=INT z: IF z<=n OR z>cmax THEN  GO TO 7110
7130 PRINT z
7140 LET cst=FN a(n): LET cend=FN a(z)+3
7150 PRINT 'TAB 2;"PUT DATA TAPE INTO RECORDER"
7160 PRINT '"SAVING ""music"" CODE ";cst;",";cend-cst-1
7170 PRINT AT 4,17; FLASH 1;m$(6)
7180 SAVE "music"CODE cst,cend-cst+1
7190 GO SUB 5200
7200 PRINT AT 4,17; FLASH 1;m$(1)
7210 RETURN
7220 REM ************************
7500 REM **** tape load ********
7510 PAPER 0: INK 7: GO SUB 8000
7520 PRINT AT 4,17; FLASH 1;m$(7)
7530 PRINT AT 12,10;"PLAY DATA TAPE"
7540 LOAD "music"CODE
7550 GO SUB 5200
7560 PRINT AT 4,17; FLASH 1;m$(1)
7570 RETURN
7580 REM ************************
8000 FOR j=8 TO 21: PRINT AT j,0;e$: NEXT j
8010 PRINT AT 9,0;
8020 RETURN
8030 REM ************************
```

(listing 4 continued from page 121)

```
        LD    B,0F7H
        CALL  KEYRT
        LD    A,E
        CP    0
        JR    Z,MKEYS
        CP    5
        JR    Z,MKEYS
        LD    D,0
        LD    HL,OVALS
        ADD   HL,DE
        LD    A,(HL)
        LD    (OCTAV),A
        PUSH  BC
        LD    HL,22817
        LD    B,12
        LD    A,48
M1      LD    (HL),A
        INC   HL
        DJNZ  M1
        XOR   A
M2      ADD   3
        DEC   E
        JR    NZ,M2
        LD    E,A
        LD    HL,22815
        ADD   HL,DE
        LD    A,176
        LD    (HL),A
        POP   BC
MKEYS   LD    DE,100H
        LD    B,0FDH
        CALL  KEYRT
        LD    B,0BFH
        CALL  KEYRT
        LD    B,0FEH
        CALL  KEYRT
        LD    B,7FH
        CALL  KEYRT
        LD    D,0
        LD    HL,KVALS
        ADD   HL,DE
        LD    A,(HL)
        CP    0
        JR    Z,3
        ADD   (IX+1)
        LD    (NOTE),A
        BIT   0,(IX+5)
        JR    Z,SOUND
        CP    (IX+2)
        JR    NZ,STORE
        INC   (IX+3)
        LD    A,255
        JR    NZ,SOUND
STORE   LD    HL,(MEMRY)
        LD    A,(LASTN)
        LD    (HL),A
        INC   HL
        LD    A,(TIME)
        LD    (HL),A
        INC   HL
        LD    (MEMRY),HL
        LD    A,(NOTE)
        LD    (LASTN),A
        LD    (IX+3),1
        BIT   0,(IX+5)
        JR    Z,SOUND
        CP    (IX+2)
        JR    NZ,STORE
        INC   (IX+3)
        LD    A,255
        CP    (IX+3)
        LD    DE,(MEND)
        AND   A
        SBC   HL,DE
        JR    C,L1
MFULL   LD    (IX+4),1
        RET
L1      INC   (IX+6)
        BIT   0,(IX+6)
        JR    NZ,SOUND
CDISP   LD    A,22
        RST   10H
        XOR   A
        RST   10H
        LD    A,17
        RST   10H
        LD    BC,(COUNT)
        INC   BC
        LD    (COUNT),BC
        CALL  1A1BH
        LD    A,32
        RST   10H
        LD    A,32
        RST   10H
        LD    A,32
        RST   10H
SOUND   LD    A,(NOTE)
        CP    0
        JR    NZ,BEEP
DELAY   LD    B,18
D1      LD    C,255
D2      DEC   C
        JR    NZ,D2
        DJNZ  D1
        JP    MAIN
BEEP    RLCA
        RLCA
        LD    E,A
        LD    D,0
        LD    HL,BVALS
        ADD   HL,DE
        LD    C,(HL)
        INC   HL
        LD    B,(HL)
        INC   HL
        LD    E,(HL)
        INC   HL
        LD    D,(HL)
        PUSH  BC
        POP   HL
        PUSH  IX
        CALL  03B5H
        POP   IX
        JP    MAIN
KEYRT   IN    A,(C)
        LD    B,5
K1      RRCA
        JR    C,1
        LD    E,D
        INC   D
        DJNZ  K1
        RET
CLEAR   XOR   A
        LD    HL,35000
        LD    B,118
C1      LD    C,255
C2      LD    (HL),A
        INC   HL
        DEC   C
        JR    NZ,C2
        DJNZ  C1
        RET
        END
```



John Nash with a routine to pep up your Dragon's commands.

SOFT KEYS

DRAGON BASIC IS housed in ROM like most other Basics, but frequently dips out into RAM where you can make various alterations. A simple method of adding commands, and a method of adding extra functions to existing routines will be described. All alterations have to be made in machine code, preferably Assembly Code, as Basic itself is a machine code program. The examples to be given are just that:— examples. The possibilities are limited only by your own imagination and requirements.

If you wish to add new commands to Basic, one way to do this is to intercept the character interpreter feed routine at $009F. This is a short but clever routine that updates itself, with the result that it jumps to $BB26 with the next code in register H. To add a new command, all you need to do is change that jump to your own interpreter, and then feed it on the $BB26 when you have finished. The Basic will continue to work as normal, and you will not get a "SN error" report, because the new code will not reach the real interpreter.

Listing 1a: Assembler listing for autorepeat.

```
        ORG   $2220
START   CMPA  #82
        BNE   BACK
        LDD   $A6
        ADDD  #1
        STD   $A6
        LDA   [$A6]
        CMPA  #65
        BEQ   ACTIV
        CMPA  #68
        BEQ   DEACT
        LDD   $A6
        SUBD  #1
        STD   $A6
        LDA   #82
BACK    JMP   $BB26
ACTIV   LDD   #$200
        STD   $10D
        JMP   $9F
DEACT   LDD   #$9D3D
        STD   $10D
        JMP   $9F
        END
```

Listing 1b: Hex. dump for autorepeat including interrupt routine.

```
512   B6 1 13 84 F 81 0 26 C 8E
522   1 50 86 FF A7 80 8C 1 60 26
532   F9 7E 9D 3D 0 0 0 0 0 0
542   0 0 81 52 26 1C DC A6 C3 0
552   1 DD A6 A6 9F 0 A6 81 41 27
562   10 81 44 27 14 DC A6 83 0 1
572   DD A6 86 52 7E BB 26 CC 2 0
582   FD 1 D E 9F CC 9D 3D FD 1
592   D E 9F 0 0 0 0 0 0 A
```

Listing 1c: Basic loader for autorepeat including interrupt routine.

```
10 DATAB6,1,13,84,F,81,0,26,C,8E
20 DATA1,50,86,FF,A7,80,8C,1,60,26
30 DATAF9,7E,9D,3D,0,0,0,0,0,0
40 DATA0,0,81,52,26,1C,DC,A6,C3,0
50 DATA1,DD,A6,A6,9F,0,A6,81,41,27
60 DATA10,81,44,27,14,DC,A6,83,0,1
70 DATADD,A6,86,52,7E,BB,26,CC,2,0
80 DATAFD,1,D,E,9F,CC,9D,3D,FD,1,D,E,9F
100 FORN=512 TO 594:READA$:POKEN,VAL("&H"+A$):NEXT
110 DATAE6,7E,B7,0,A8,86,02,B7,0,A9,86,20,B7,0,AF,39
120 FORN=12000 TO 12015:READA$:POKEN,VAL("&H"+A$):NEXT
130 EXEC12000
```

DRAGON

Listing 2: Assembler listing

```
00100            ORG     $2200
00110 BEGIN      LDA     $113
00120            ANDA    #$0F
00130            CMPA    #0
00140            BNE     NOTNOW
00150            LDX     #$150
00160            LDA     #$FF
00170 LOOP       STA     ,X+
00180            CMPX    #$160
00190            BNE     LOOP
00200 NOTNOW     JMP     $9D3D
00210            END
```

Listing 3a: Assembler listing for Run question routine.

```
00100            ORG     $2200
00110 KB         EQU     $8006
00115            PSHS    D,X,Y
00120 START      LDX     #$400
00130            LDA     #$20
00140 LOOP       STA     ,X+
00150            CMPX    #$600
00160            BNE     LOOP
00170 WRITE      LDX     #$500
00180            LDY     #STORE
00190 LOOP2      LDA     ,Y+
00200            STA     ,X+
00210            CMPX    #$505
00220            BNE     LOOP2
00230 SCAN       JSR     KB
00240            CMPA    #0
00250            BEQ     SCAN
00260            CMPA    #'Y
00270            BNE     DONT
00280            PULS D,X,Y,PC
00290 DONT       PULS    D,X,Y
00295            JMP     $B4AA
00300 STORE      FCC     /SURE?/
00310            END
```

Listing 3b: Hex. dump for Run question.

```
512   34 36 8E 4 0 86 20 A7 80 8C
522   6 0 26 F9 8E 5 0 10 8E 2
532   30 A6 A0 A7 80 8C 5 5 26 F7
542   BD 80 6 81 0 27 F9 81 59 26
552   2 35 B6 35 36 7E B4 AA 53 55
562   52 45 3F 0 0 0 0 0 0 0
```

An example will make this clearer: listing 1a.

I wanted to add an auto-repeat to my keyboard, and decided to use RA — Repeat Activate — to turn it on, and RD — Repeat Deactivate — to turn it off. Obviously it is better if you do not use existing Basic words.

Line 100 sets origin to $2220, which I shall later move to $0220, which my assembler regards as a forbidden area. Putting the code between $0200 and $02FF will make it invisible to Basic programs, and will not consume any usable memory. But exceed $0300 at your peril

Line 110 checks for "R" and returns if not.
Line 130-150 increment the text pointer at $00A6.
Line 160,170 get the next character and check for "H".
Line 180 branches to ACTIV if so.
Line 190 checks for "D" and branches to DEACT if so.
Line 210-240 restore $00A6, and put "R" back in it if neither "H" nor "D" is found.
Line 250 then passes the "R" on to the proper interpreter.
ACTIV alters the interrupt vector in $10D/E to go to a new routine at £0200, and DEACT alters the interrupt vector back to its usual destination of $9D3D.

A few words of explanation about the interrupt; this is a subroutine which is called 50 times per second when enabled. You can divert it to small routines of your own before sending it about its usual tasks. If your routines are too long in time, it will slow the Basic. However you can use it for anything needing frequent updating, such as timers, graphics, and in my program, for clearing the keyboard rollover table, and thus providing an autorepeat. Now look at listing 2a.

Line 100 sets the origin to $2200. This routine will sit nicely at $0200, just below the other one.
Line 110 gets the timer value — incremented 50 times/sec.
Line 120 ANDs this value with $0F (1111 binary), which will only look at the last four bits. If these are zero, then the rollover table is cleared (set to $FF) by line 150-190. Finally the routine passes control to $9D3D, the normal interrupt vector. This routine at $0200 will only be enabled if you have pressed RA (return). You will find that you can also use RH and RD in program lines, but they must be prefaced by REM. This will not be ignored by the new interpreter routine. If you wish to vary the speed of repeat, POKE a different number into $204 — decimal 516.

This technique can be used for redefining single keys also, but you will then need another routine to decide whether to send the character to the new interpreter or not. You could for example use a routine KON — key-on — which would store the address of the new interpreter in $A8, thus enabling single key functions, and another routine KOF — key-off — which would put JMP $BB26 back into $A8 as before. The possibilities are considerable.

You cannot just Poke addresses such as the interrupt and keyboard vectors — $10D/E and $A9/10 — or the system will crash. For the method of making these alterations see below.

Several Basic routines branch, usually with a JSR instruction, to RAM locations. These normally contain just RTS ($39), so control is sent straight back to the ROM routine. Some of these can be useful: the ones I have used are:

Character Input	$167
Character Output	$16A
Error	$18E
Run	$194
Read next word	$19A

Some of these can be Poked directly from Basic — Run, Error — but with others this will cause a crash because the routine will go through the address with the POKE only half complete. In this case you must use a short machine code routine to do the Poking such as:

LDA $7E (code for JUMP extended)
STA $NN (where NN s $18E in the case of Error)
LDD #$PPQQ (where PPQQ is the start of your routine)
STD $185 (in the case of Error)
RTS

(continued on page 129)

(continued from page 127)
which has the same effect but uses only the A register.

Now look at listing 3a. This routine is vectored from Run, so when you type Run you will go via the new routine. The effect is to clear the screen to black, then print "SURE?" and wait for a key press. If you respond Y the Run command will be executed as usual, but any other key will cause the system start-up message to appear — your Basic program will neither be Run nor erased.

Line 100 Listing 3A too is assembled at $2200 and moved to $0200. Note that you must move the FCC text string address also, see legend for Figure 3.
Line 110 Define keyboard scan ROM address
Line 115 Stack D,X,Y for safe-keeping
Line 120-160 Copy black space ($20) to all text screen ($400 to $5FF)
Line 170-220 Copy 5 characters from $STORE to $500-$504 (half way down the screen)
Line 230-250 Wait for key
Line 260 Is it "Y", if so 280
Line 280 Get back D,X,Y,PC (i.e. return)

Listing 3c: Basic loader for Run question.

```
10 DATA34,36,8E,4,0,86,20,A7,80,8C
20 DATA86,0,26,F9,8E,5,0,10,8E,2
30 DATA30,A6,A0,A7,80,8C,5,5,26,F7
40 DATABD,80,6,81,0,27,F9,81,59,26
50 DATA2,35,B6,35,36,7E,B4,AA,53,55
60 DATA52,45,3F
100 FORN=512 TO 564:READA$:POKEN,VAL("&H
"+A$):NEXT
110 POKE&H195,2:POKE&H196,0:POKE&H194,12
6
```

Line 270 No it wasn't "Y" so 290
Line 290-295 Get back D,X,Y and Jump to $B4AA (start-up)

This is only a simple example, but you could obviously adapt the technique to write various messages on error, etc.

The routine in listing 4 is a synthesis of some of these techniques and will check for the command New. If this is found, it will clear the screen and print "CONFIRMATION?" and wait for a key. If Y, it will execute the NEW, otherwise it will restart Basic as above, without losing the program. The assembly code is given in Listing 4a, which is merely a re-arrangement of the routines explained above. Once again, if you are using an assembler, you will probably have to assemble it elsewhere and move it, in which case do not forget to move the FCC text address also — legend 4b.

Finally, it is possible to disable Break by changing the stack pointer and jumping over a subroutine call. The extra code can be Poked into $19A to $19E provided that you Poke $19H last of all. The following code

```
POKE &H19B,6
POKE &H19C,&H7E
POKE &H19D,&H84
POKE &H19E,&HA6
POKE &H19A,&H35 (note the order).
PULS D (pop one from stack)
    JMP $84A6 (skips over BREAK check)
```

To disable this, POKE&H19A,&H39.

Any of these routines, once loaded, can be saved for future use by the following:

CSAVEM"NAME",168,637,470

You can then erase the Basic program as it is no longer needed. To reload from tape, type CLoadM. ■

Listing 4a: Assembler listing for New protect routine.

```
00100          ORG    $2200
00110 KB       EQU    $8006
00120 START    CMPA   #'N
00130          BNE    BACK
00140          BSR    INC
00150          LDA    [$A6]
00160          CMPA   #'E
00170          BNE    BACK2
00180          BSR    INC
00190          LDA    [$A6]
00200          CMPA   #'W
00210          BNE    BACK3
00220          PSHS   X,Y
00230          LDX    #$400
00240          LDA    #$60
00250 LOOP     STA    ,X+
00260          CMPX   #$600
00270          BNE    LOOP
00280 WRITE    LDX    #$500
00290          LDY    #MESSAG
00300 LOOP2    LDA    ,Y+
00310          STA    ,X+
00320          CMPX   #$50D
00330          BNE    LOOP2
00340 SCAN     JSR    KB
00350          CMPA   #0
00360          BEQ    SCAN
00370          CMPA   #'Y
00380          BNE    DONT
00390          PULS   X,Y
00400          JMP    $8415    /NEW
00410 DONT     PULS   X,Y
00420          JMP    $B4AA
00430 BACK     LDA    [$A6]
00435          JMP    $BB26
00440 BACK2    BSR    DEC
00450          BRA    BACK
00460 BACK3    BSR    DEC
00470          BSR    DEC
00480          BRA    BACK
00490 INC      LDD    $A6
00500          ADDD   #1
00510          STD    $A6
00520          RTS
00530 DEC      LDD    $A6
00540          SUBD   #1
00550          STD    $A6
00560          RTS
00570 MESSAG   FCC    /CONFIRMATION?/
00580          END
```

Listing 4b: Hex. dump for New protect.

```
512    81 4E 26 47 8D 56 A6 9F 0 A6
522    81 45 26 44 8D 4C A6 9F 0 A6
532    81 57 26 3E 34 30 8E 4 0 86
542    60 A7 80 8C 6 0 26 F9 8E 5
552    0 10 8E 2 6C A6 A0 A7 80 8C
562    5 D 26 F7 BD 80 6 81 0 27
572    F9 81 59 26 5 35 30 7E 84 15
582    35 30 7E B4 AA A6 9F 0 A6 7E
592    BB 26 8D 10 20 F5 8D C 8D A
602    20 EF DC A6 C3 0 1 DD A6 39
612    DC A6 83 0 1 DD A6 39 43 4F
622    4E 46 49 52 4D 41 54 49 4F 4E
632    3F 0 0 0 0 0 0 0 0 0
```

Listing 4c: Basic loader for New protect.

```
10 DATA81,4E,26,47,8D,56,A6,9F,0,A6
20 DATA81,45,26,44,8D,4C,A6,9F,0,A6
30 DATA81,57,26,3E,34,30,8E,4,0,86
40 DATA60,A7,80,8C,6,0,26,F9,8E,5
50 DATA0,10,8E,2,6C,A6,A0,A7,80,8C
60 DATA5,D,26,F7,BD,80,6,81,0,27
70 DATAF9,81,59,26,5,35,30,7E,84,15
80 DATA35,30,7E,B4,AA,A6,9F,0,A6,7E
90 DATABB,26,8D,10,20,F5,8D,C,8D,A
100 DATA20,EF,DC,A6,C3,0,1,DD,A6,39
110 DATADC,A6,83,0,1,DD,A6,39,43,4F
120 DATA4E,46,49,52,4D,41,54,49,4F,4E
130 DATA3F
200 FORN=512 TO 632:READA$:POKEN,VAL("&H
"+A$):NEXT
210 DATA86,2,B7,0,A9,86,0,B7,0,AA,39
220 FORN=12000 TO 12010:READA$:POKEN,VAL
("&H"+A$):NEXT
230 EXEC12000
```

DATACALC

Brain Law presents a spreadsheet program for the ZX-81 which works on columns of figures rather than on individual cells.

Figure 1.

Mode	*Command*	*Description*	*What is required next*	*Sub command*	*What they do*
Menu	1	To enter existing sheet	–	–	–
	2	To set up new sheet	Enter number of columns required	–	
Cursor	5	Move cursor left	Holding down at edge if screen will move sheet along 1 column	–	–
	8	Move cursor right			
	7	Move cursor up	–	–	–
	6	Move cursor down	–	–	–
Main sheet	H	Headings to be used up to current cursor row	NB! Move cursor to the row where headings finish first	–	–
	T	Titles required in column 1	NB! Text can only be used in column 1	–	–
	K *	To enter a column of figures	Enter each figure or title in turn cursor jumps to next row after entry	N/L	Cursor increments one row, leaving existing figure or title unchanged
	A *	To add or amend an entry	Enter Figure or title	R	Returns operation of cursor mode
	F	Enter formula over current column	eg K1 × K2 multiply values in volumn 1 by values in column 2	P	Progressively soms previous column
				I	Inverts values in previous column
	C	Calculate the whole sheet			
	J	Jump to another column	Enter column number to be at first position on screen	–	–
	D	Drop or rise	Enter row number to be at top of the screen	–	–
	S	Sum of current column	–	–	
	X	Delete sum of current column	–	–	–
	M	Rounds up decimals to two places and aligns print out on decimal point	–	–	–
	L	Overprints column 1 onto first screen column	–	–	–
	O	Sorts current column into ascending order	NB! All other columns follow the sort		
	V	Save existing sheet	–	–	–
	P	Prints copy of screen	–	–	–

* by adding A":" to a figure or title it will be repeated in all subsequent columns in current row.

DATACALC IS A general purpose spreadsheet type program for use on the ZX-81 with 16K RAM.

When loaded the program will run automatically and display a menu asking you to enter a 1 or a 2, 1 gives you the sheet that was Saved. It will actually give you error code 2/1045 if only the program was Saved.

Entering 2 asks you for the number of rows to be used, followed by the number of columns. Enter 10 N/L and then 10 N/L. This should give you a display showing 10 rows and three columns on the screen, with a flahsing cursor in the top left hand corner.

To demonstrate the use of the program I shall use a simple example showing the calculation of profits on a range of products sold by a shopkeeper.

To enter column 1 as shown in figure 2 press the key K, the screen blanks out for a short time and then returns with the cursor fixed in row 1 of column 1. Now enter a space ' ' this blanks out the zero that was there. You will notice that the cursor has moved down to the next row ready for you to make the next entry, so now enter 'PRODUCT' N/L. To underline all of the headings enter '__________:'. The : at the end tells the computer to enter this same string into each column along the row. Now enter each name in turn.

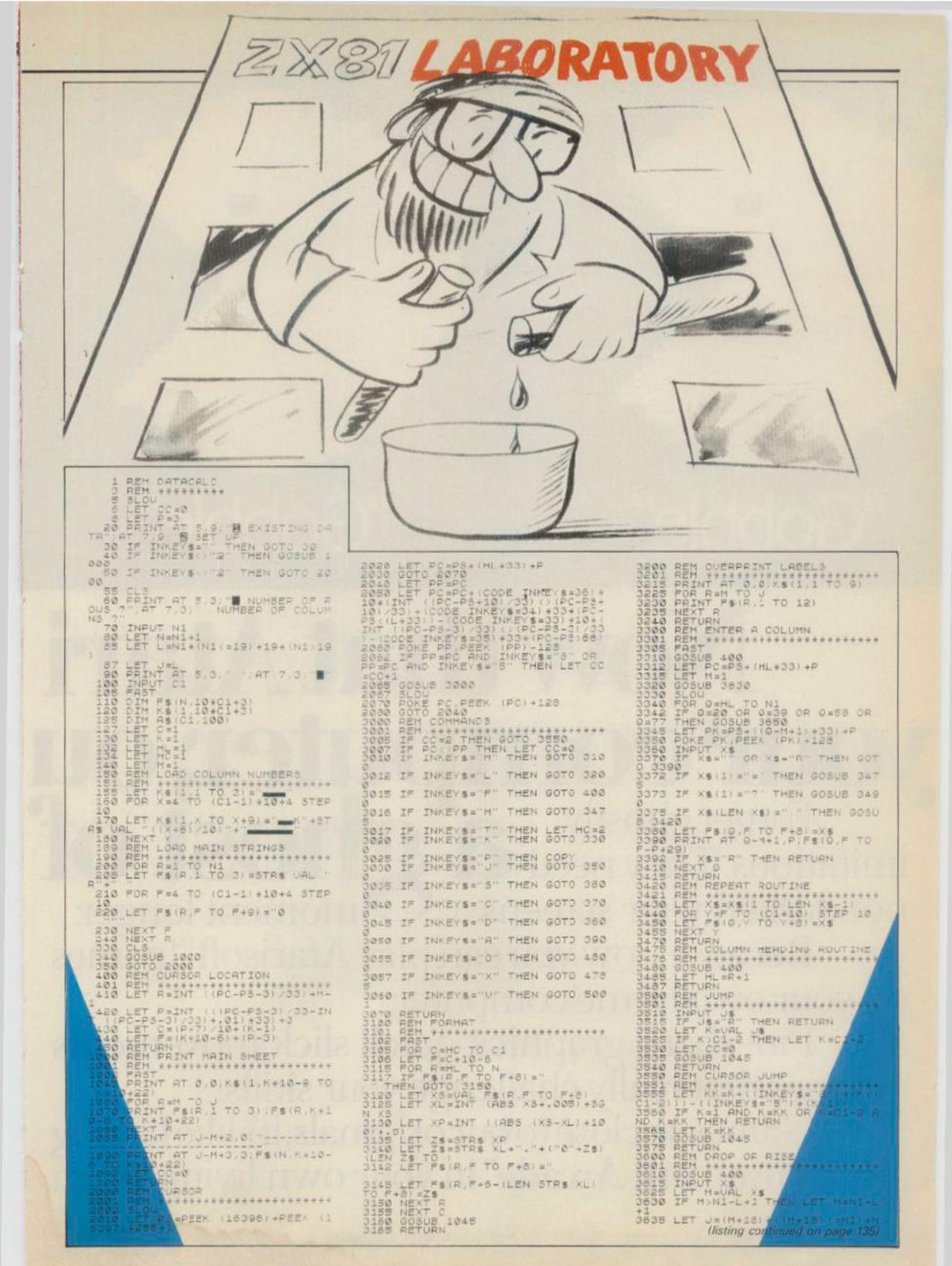
To prevent errors in calculation later on the computer needs to be told where headings and titles are. In the case of titles these can only be put into column 1 anyway, so to tell the computer you are using column 1 for titles press T for two or three seconds. The headings can take up as many of the top rows as you like, so to tell the computer where they finish, move the flashing cursor down to row 3 by hold down the 6 key and then press H.

To enter the next column move the cursor using the cursor keys to column 2 row 1, now press 'A' followed by the word 'SALES' then move cursor down to row 2 press 'A' again followed by the word 'VOLUME'. Now press K and enter each of the values in turn. You will have noticed that the cursor moved automatically to row 4 after pressing K.

This is why the A command was used to put in the headings. A is the command used when entries are made into individual cells. Anyway repeat the above procedure to enter headings and data into column 3, then by holding the 8 key down the sheet will be re-written to bring column 4 onto the screen. After filling in the headings press key F the computer will now be waiting for you to enter a formula.

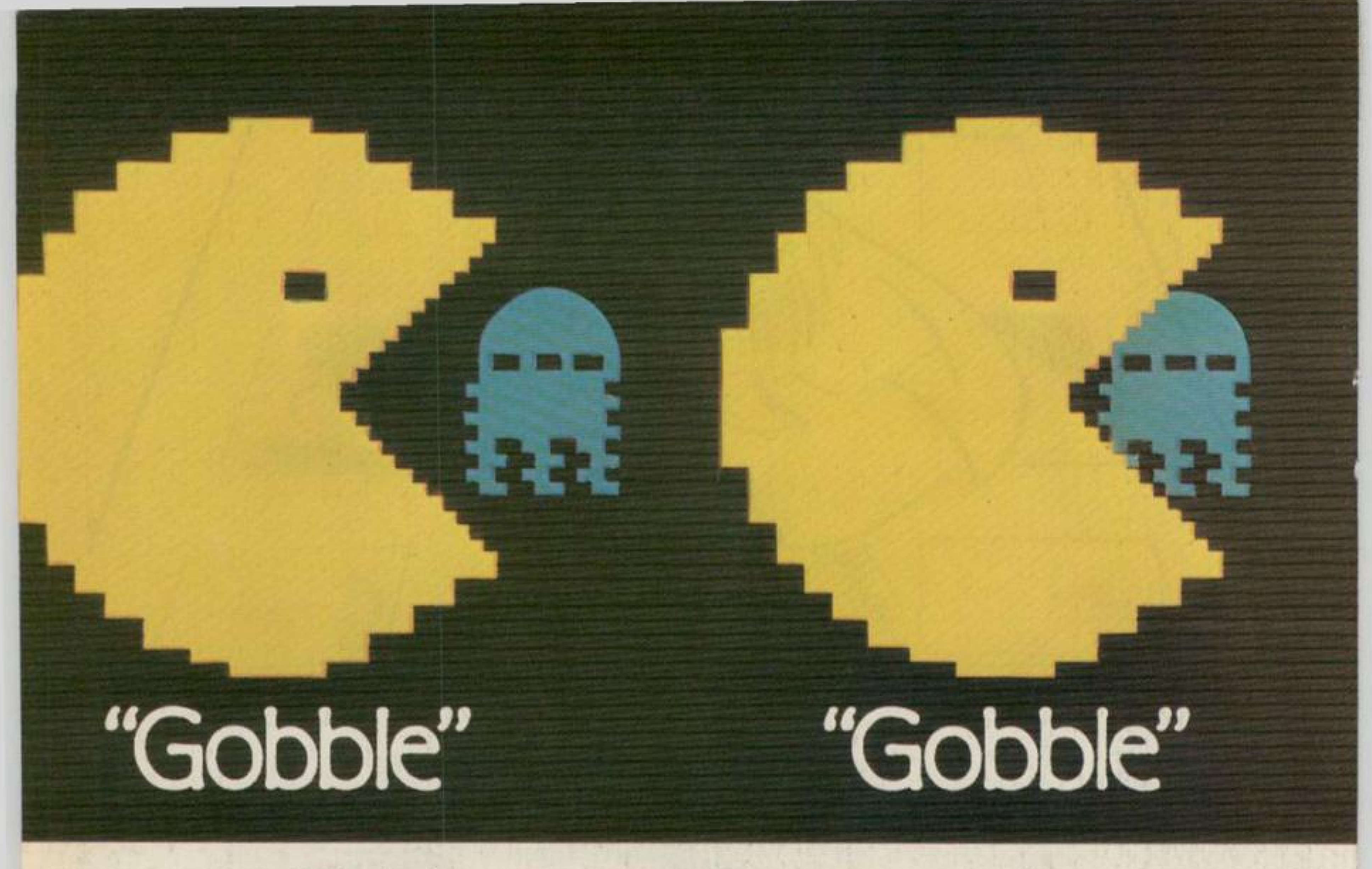
A formula in Datacalc can take several forms, in this case we want to multiply the Sales Volume by the Sales Price to get the Turnover for each product. This is to say that we wish to multiply each value in column 2 by

(continued on page 135)




```
   1 REM DATACALC
   3 REM *********
   5 SLOW
   6 LET CC=0
   8 LET P=3
  20 PRINT AT 5,9;"█ EXISTING DA
TA";AT 7,9;"█ SET UP"
  30 IF INKEY$="" THEN GOTO 30
  40 IF INKEY$<>"2" THEN GOSUB 1
000
  50 IF INKEY$<>"2" THEN GOTO 20
00
  55 CLS
  60 PRINT AT 5,3;"█ NUMBER OF R
OWS ?";AT 7,3;"  NUMBER OF COLUM
NS ?"
  70 INPUT N1
  80 LET N=N1+1
  85 LET L=N1*(N1<=19)+19*(N1>19
)
  87 LET J=L
  90 PRINT AT 5,3;" ";AT 7,3;"█"
 100 INPUT C1
 105 FAST
 110 DIM F$(N,10*C1+3)
 120 DIM K$(1,10*C1+3)
 125 DIM A$(C1,100)
 127 LET C=1
 130 LET K=1
 132 LET HL=1
 134 LET HC=1
 140 LET M=1
 150 REM LOAD COLUMN NUMBERS
 151 REM ************************
 155 LET K$(1,1 TO 3)="███"
 160 FOR X=4 TO (C1-1)*10+4 STEP
 10
 170 LET K$(1,X TO X+9)="██K"+ST
R$ VAL "((X+6)/10)"+"████████"
 180 NEXT X
 189 REM LOAD MAIN STRINGS
 190 REM ************************
 200 FOR R=1 TO N1
 205 LET F$(R,1 TO 3)=STR$ VAL "
R"+" "
 210 FOR F=4 TO (C1-1)*10+4 STEP
 10
 220 LET F$(R,F TO F+9)="0
     "
 230 NEXT F
 240 NEXT R
 330 CLS
 340 GOSUB 1000
 350 GOTO 2000
 400 REM CURSOR LOCATION
 401 REM ************************
 410 LET R=INT ((PC-PS-3)/33)+M-
1
 420 LET P=INT (((PC-PS-3)/33-IN
T ((PC-PS-3)/33)+.01)*33)+3
 430 LET C=(P-7)/10+(K-1)
 440 LET F=(K*10-6)+(P-3)
 450 RETURN
1000 REM PRINT MAIN SHEET
1001 REM ************************
1002 FAST
1045 PRINT AT 0,0;K$(1,K*10-9 TO
 K*10+22)
1060 FOR R=M TO J
1070 PRINT F$(R,1 TO 3);F$(R,K*1
0-6 TO K*10+22)
1080 NEXT R
1085 PRINT AT J-M+2,0;"---------
-----------------------"
1090 PRINT AT J-M+3,3;F$(N,K*10-
6 TO K*10+22)
1092 LET CC=0
1100 RETURN
2000 REM CURSOR
2001 REM ************************
2002 SLOW
2010 LET PS=PEEK (16396)+PEEK (1
6397)*256+1
2020 LET PC=PS+(HL*33)+P
2030 GOTO 2070
2040 LET PP=PC
2050 LET PC=PC+(CODE INKEY$=36)*
10*(INT ((PC-PS+10)/33)<>(PC-PS+
10)/33)+(CODE INKEY$=34)*33*(PC-
PS<(L*33))-(CODE INKEY$=33)*10*(
INT ((PC-PS-3)/33)<>(PC-PS-3)/33
)-(CODE INKEY$=35)*33*(PC-PS>66)
2060 POKE PP,PEEK (PP)-128
2062 IF PP=PC AND INKEY$="8" OR
PP=PC AND INKEY$="5" THEN LET CC
=CC+1
2065 GOSUB 3000
2067 SLOW
2070 POKE PC,PEEK (PC)+128
2080 GOTO 2040
3000 REM COMMANDS
3001 REM ************************
3005 IF CC=2 THEN GOTO 3550
3007 IF PC<>PP THEN LET CC=0
3010 IF INKEY$="M" THEN GOTO 310
0
3012 IF INKEY$="L" THEN GOTO 320
0
3015 IF INKEY$="F" THEN GOTO 400
0
3016 IF INKEY$="H" THEN GOTO 347
5
3017 IF INKEY$="T" THEN LET HC=2
3020 IF INKEY$="K" THEN GOTO 330
0
3025 IF INKEY$="P" THEN COPY
3030 IF INKEY$="J" THEN GOTO 350
0
3035 IF INKEY$="S" THEN GOTO 360
0
3040 IF INKEY$="C" THEN GOTO 370
0
3045 IF INKEY$="D" THEN GOTO 360
0
3050 IF INKEY$="A" THEN GOTO 390
0
3055 IF INKEY$="O" THEN GOTO 450
0
3057 IF INKEY$="X" THEN GOTO 475
5
3060 IF INKEY$="U" THEN GOTO 500
1
3070 RETURN
3100 REM FORMAT
3101 REM ************************
3102 FAST
3105 FOR C=HC TO C1
3106 LET F=C*10-6
3115 FOR R=HL TO N
3117 IF F$(R,F TO F+8)="
  " THEN GOTO 3150
3120 LET XS=VAL F$(R,F TO F+8)
3125 LET XL=INT (ABS XS+.005)*SG
N XS
3130 LET XP=INT ((ABS (XS-XL)*10
0)+.5)
3135 LET Z$=STR$ XP
3140 LET Z$=STR$ XL+"."+("0"+Z$)
(LEN Z$ TO )
3142 LET F$(R,F TO F+8)="
  "
3145 LET F$(R,F+6-(LEN STR$ XL)
TO F+8)=Z$
3150 NEXT R
3155 NEXT C
3160 GOSUB 1045
3165 RETURN
3200 REM OVERPRINT LABELS
3201 REM ************************
3215 PRINT AT 0,0;K$(1,1 TO 9)
3225 FOR R=M TO J
3230 PRINT F$(R,1 TO 12)
3235 NEXT R
3240 RETURN
3300 REM ENTER A COLUMN
3301 REM ************************
3305 FAST
3310 GOSUB 400
3312 LET PC=PS+(HL*33)+P
3315 LET M=1
3320 GOSUB 3630
3330 SLOW
3340 FOR O=HL TO N1
3342 IF O=20 OR O=39 OR O=58 OR
O=77 THEN GOSUB 3650
3345 LET PK=PS+((O-M+1)*33)+P
3350 POKE PK,PEEK (PK)+128
3360 INPUT X$
3370 IF X$="" OR X$="R" THEN GOT
O 3390
3372 IF X$(1)="=" THEN GOSUB 347
5
3373 IF X$(1)="?" THEN GOSUB 349
0
3375 IF X$(LEN X$)=" " THEN GOSU
B 3420
3380 LET F$(O,F TO F+8)=X$
3390 PRINT AT O-M+1,P;F$(O,F TO
F-P+29)
3392 IF X$="R" THEN RETURN
3410 NEXT O
3415 RETURN
3420 REM REPEAT ROUTINE
3421 REM ************************
3430 LET X$=X$(1 TO LEN X$-1)
3440 FOR Y=F TO (C1*10) STEP 10
3450 LET F$(O,Y TO Y+8)=X$
3455 NEXT Y
3470 RETURN
3475 REM COLUMN HEADING ROUTINE
3476 REM ************************
3480 GOSUB 400
3485 LET HL=R+1
3487 RETURN
3500 REM JUMP
3501 REM ************************
3510 INPUT J$
3515 IF J$="R" THEN RETURN
3520 LET K=VAL J$
3525 IF K>C1-2 THEN LET K=C1-2
3530 LET CC=0
3535 GOSUB 1045
3540 RETURN
3550 REM CURSOR JUMP
3551 REM ************************
3555 LET KK=K+((INKEY$="8")*(K<(
C1-2)))-((INKEY$="5")*(K>1))
3560 IF K=1 AND K=KK OR K=C1-2 A
ND K=KK THEN RETURN
3565 LET K=KK
3570 GOSUB 1045
3575 RETURN
3600 REM DROP OR RISE
3601 REM ************************
3610 GOSUB 400
3615 INPUT X$
3625 LET M=VAL X$
3630 IF M>N1-L+1 THEN LET M=N1-L
+1
3635 LET J=(M+18)*((M+18)<=N1)+N
```

(listing continued on page 135)


"Gobble"
"Gobble"

"Gobble"

"Gulp"

make games for r rivals don't stand a chance.

We've written the programs to suit your computer's exact requirements.

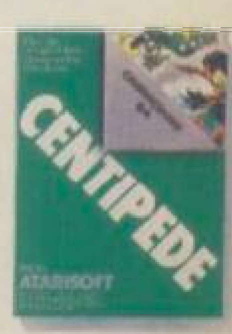
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ATARISOFT™

	K1 PRODUCT	K2 " SALES " VOLUME	K3 " SALES " PRICE	K4 TURNOVER"	K5 " COST EACH	K6 " TOTAL " COST	K7 PROFIT	K8 " PERCENT " PROFIT
4	JIGSAW	"1000	"13.00	13000	"11.00	"11000	2000	"9.8522167
5	BANDSAW	"200	"70.00	14000	"57.00	"11400	2600	"12.807882
6	BENCH SAW	"700	"35.00	24500	"31.00	"21700	2800	"13.793104
7	DRILL	"1500	"15.00	22500	"13.00	"19500	3000	"14.778325
8	ROUTER	"1100	"20.00	22000	"17.00	"18700	3300	"16.256158
9	SANDER	"1300	"18.00	23400	"15.00	"19500	3900	"19.211823
10	TOOL BOX	"900	"7.00	6300	"4.00	"3600	2700	"13.300493
				125700		105400	20300.00	

Figure 2.

(continued from page 131)

its corresponding value in column 3. The formula used to do this is k2 * k3.

To find the total turnover for all the products we need to add together all the individual values in column 4, to do this simply press S.

We can move across the sheet by more than one column at a time by using the J command. For example we need to enter figures into column 5 next, so press J followed by 5 — that is — column 5 — the sheet is now re-written with columns 5, 6 and 7 on the screen. Before doing anything else put in the headings for these columns.

Before moving back to column 5 to enter the cost figures it would be rather nice to have the products listed down the screen to see which product the costs referred to, so use the J command again to get the screen to show columns 4, 5 and 6 — that is 'J' '4' N/L. Now press L this overprints the first screen column with column 1.

Now use the K command and enter figures into column 5. Move the cursor to column 6 now and press F again ready for entering another formula. This formula is to calculate the total costs which is the cost of each multiplied by the sales volume i.e. K2 * K5. Enter this formula and then use the S.

Move the cursor now to column 7 either by keeping the cursor pressed down or by using the J command and after putting in the heading enter the formula K4-K6 to find the project for each product. Use S again to find total profit.

Finally, move the column 8, put in the heading and press F to enter the formula for percentage profit. What we will be calculating here is what percentage of the total profit each individual product makes.

Now total profit is the sum of all individual profits and is the figure at the bottom of column 7 calculated by the 'S' command. The formula to be entered is K7/S7 * 100.

Now to demonstrate one of the features of Datacalc not normally found in spreadsheet programs, that is the SORT command. Put the cursor on column 8 and press 0 the computer will sort on column 8 and rearrange it into asscending order — that is lowest figure at the top.

All the other entries along a given row are also moved into the new order at the same time. Use the 'L' command again to print the product names.

Now move the cursor back to column 2 and position it over the 1,000 figure for the jigsaw press A and put in a new value, say 1,450. Now press C this will recalculate the whole sheet, if you move back to column 8 you will see that all the values have been changed slightly and need re-ordering so press 0 again.

To tidy up the display press M.

It was mentioned earlier that a formula can take several forms, and we have used one of those forms when we multiply 2 columns together, for example K2 * K3. You can also use it for calculations of the type (27.5×6)-5 or π×17/4 in fact any of the computer's own functions can be used; for example INT(π*30) is quite valid.

An interesting variation is achieved, however, if the letter R is used in a formula. Now R is the variable used in the program to denote the row number. If R is used on its own it will result in the row number being printed in each row of a column or if used in combination with some other function or number it can be used to increment for example, 10 + (R x.1) will progressively increment the value 10 by 10 percent.

The reversal of this formula will of course decrement the value. R is therefore a powerful tool for loading data into the worksheet. Two other useful functions are provided under the F command if you enter the letter P as a formula you will get a progressive sum of the previous column. If you enter I you will get the previous column inverted. ■

(listing continued from page 132)

```
1*((M+18)>N1)
3640 GOSUB 1045
3645 RETURN
3650 REM DROP ONE PAGE
3651 REM ***********************
3652 FAST
3653 CLS
3655 LET M=M+19
3660 LET J=(M+18)*((M+18)<=N1)+N
1*((M+18)>N1)
3670 GOSUB 1045
3675 SLOW
3680 RETURN
3700 REM CALCULATE
3701 REM ***********************
3705 FAST
3710 FOR C=HC TO C1
3720 LET F=C*10-6
3730 IF A$(C,1)=" " THEN GOTO 37
90
3740 FOR R=HL TO N1
3760 LET F$(R,F TO F+8)=STR$ VAL
 A$(C)
3770 NEXT R
3780 IF F$(N,F)<>" " THEN GOSUB
3810
3790 NEXT C
3792 GOSUB 1045
3795 RETURN
3800 REM SUM OF A COLUMN
3801 REM ***********************
3805 GOSUB 400
3808 FAST
3810 LET S=0
3820 FOR R=HL TO N1
3830 LET S=S+VAL F$(R,F TO F+8)
3840 NEXT R
3850 LET F$(N,F TO F+8)=STR$ VAL
 "S"
3870 GOSUB 1090
3880 RETURN
3900 REM ADD OR AMEND
3901 REM ***********************
3910 POKE PC,PEEK (PC)+128
3920 GOSUB 400
3930 LET D=R
3950 INPUT X$
3960 IF X$="R" OR X$="" THEN GOT
O 3990
3965 IF X$(1)="*" THEN GOSUB 347
5
3967 IF X$(1)="?" THEN GOSUB 349
0
3970 IF X$(LEN X$)=":" THEN GOSU
B 3420
3980 LET F$(R,F TO F+8)=X$
3990 PRINT AT R-M+1,P;F$(R,F TO
F-P+31)
3992 IF F$(N,F)<>" " THEN GOSUB
3805
3995 RETURN
4000 REM FORMULA ENTRY
4001 REM ***********************
4005 FAST
4010 GOSUB 400
4020 INPUT A$(C)
4030 GOSUB 4500
4031 GOSUB 400
4040 FOR R=HL TO N1
4060 LET F$(R,F TO F+8)=STR$ VAL
 A$(C)
4070 NEXT R
4075 IF A$(C,1 TO 3)="R  " THEN
LET A$(C)=""
4080 IF F$(N,F)<>" " THEN GOSUB
3810
4090 GOSUB 1045
4095 RETURN
4500 REM FORMULA ENCODE
4501 REM ***********************
4505 IF A$(C,1)="P" THEN GOTO 47
30
4510 IF A$(C,1)="I" THEN GOTO 47
55
4515 LET X=1
4520 LET A=1
4522 IF A$(C,A+1 TO A+3)="   " T
HEN GOTO 4530
4524 LET A=A+1
4526 GOTO 4522
4530 LET B$=A$(C)
4540 LET C$=""
4550 IF X>A+1 THEN GOTO 4710
4560 REM
4570 IF B$(X)<>"K" AND B$(X)<>"S
" THEN GOTO 4640
4580 LET X$="R"
4590 IF B$(X)<>"K" THEN LET X$="
N"
4600 IF B$(X+2)=")" OR B$(X+2)="
*" OR B$(X+2)="/" OR B$(X+2)="**
" OR B$(X+2)="+" OR B$(X+2)="-"
THEN GOTO 4670
4605 LET F=VAL (B$(X+1 TO X+2))*
10-6
4610 LET C$=C$+"VAL F$("+X$+","+
STR$ VAL "F"+" TO "+STR$ VAL "F+
8"+")"
4620 LET X=X+3
4630 GOTO 4550
4640 LET C$=C$+B$(X)
4650 LET X=X+1
4660 GOTO 4550
4670 LET F=VAL B$(X+1)*10-6
4680 LET C$=C$+"VAL F$("+X$+","+
STR$ VAL "F"+" TO "+STR$ VAL "F+
8"+")"
4690 LET X=X+2
4700 GOTO 4550
4710 LET A$(C)=C$
4720 RETURN
4730 REM PROGRESSIVE SUM
4731 REM ***********************
4745 LET A$(C)="VAL F$(R,F-10 TO
 F-2)*(R<>HL)+VAL F$(R-1*(R<>HL)
,F TO F+8)"
4750 RETURN
4755 REM INVERT COLUMN
4756 REM ***********************
4770 LET A$(C)="VAL F$(N-(R-HL+1
),F-10 TO F-2)"
4780 RETURN
4785 REM CANCEL SUM
4786 REM ***********************
4790 GOSUB 400
4792 LET F$(N,F TO F+8)="
"
4794 GOTO 1090
4800 REM SORT
4801 REM ***********************
4805 FAST
4810 GOSUB 400
4820 LET R=1
4830 IF 2**R>N1 THEN GOTO 4860
4840 LET R=R+1
4850 GOTO 4830
4860 LET F1=2**R-1
4870 LET F1=INT (F1/2)
4880 IF F1=0 THEN GOTO 1045
4890 LET D=N1-F1
4900 LET B=1
4910 LET R=B
4920 LET E=R+F1
4925 IF R<HL OR E<HL THEN GOTO 4
940
4930 IF VAL F$(R,F TO F+8)>VAL F
$(E,F TO F+8) THEN GOTO 4955
4940 LET B=B+1
4945 IF B>D THEN GOTO 4870
4950 GOTO 4910
4955 LET X$=F$(R,3 TO )
4960 LET F$(R,3 TO )=F$(E,3 TO )
4965 LET F$(E,3 TO )=X$
4970 LET R=R-F1
4975 IF R<1 THEN GOTO 4940
4980 GOTO 4920
5000 REM SAVE
5001 REM ***********************
5002 SAVE "DATACAL█"
5003 CLS
5004 GOTO 1
```



Kathleen Peel continues the series on Microdrives with a look at how to create paint commands.

THE MICRODRIVE FILE

WITH THE INTRODUCTION of Interface 1 the Spectrum entered a new phase. Previously the only commands that could be used were those laid out on the keyboard, this is now no longer true.

The Spectrum coupled to Interface 1 has the capability of creating new commands which will be checked for syntax on entry just like any of the existing commands.

There is only one allusion to this facility in the Microdrive and Interface manual in the list of system variables, which is a little surprising as Sinclair is not known for his reticence in expounding the virtues of his products.

As this subject is a little tricky to understand, I think the best way of demonstrating a technique of creating a new command is by stepping very slowly through an example. There are many ways of creating new commands, some more complex than others, in this instance we will use a fairly simple technique.

As with all articles in the series we will take a simplistic view of what is happenning in order to present the least complicated approach. In other words, I may lie a little here and there to explain a principle.

Perhaps before we actually produce the command a few words on a systematic approach to storing these commands is required.

The new commands, like the old ones, consist of machine code routines stored in memory, but in RAM and not ROM. This obviously will cause problems in positioning the code in memory as it is not known what other software and commands are required. The user may require a monitor, an assembler or even a compiler, so it needs to be carefully thought through to enable the commands to work with any software resident in memory.

The approach used is to use the top of Basic to hold subroutines for the new commands and as a later article, the cassette backup routines necessary to off-line all your cartridge files. The off-lining of files is thought necessary as at £5 each cartridge with an unknown life span, the cost mounts up extremely quickly. I have nine and that's £45, I mean cartridges not lives.

To be able to use the routines as and when necessary, each routine must be relocatable and have a predetermined entry point which is relative rather than absolute. This will enable routines to be stacked in any order in any position in RAM giving a high degree of flexibility.

That is just jargon for saying I do not know what I am doing so better leave myself lots of options.

The example chosen is a very simple paint command, the command itself is not important, it is the technique in creating syntax and run time checks that you should follow.

If you type in a command which the computer does not understand then it finds its error routines, works out what is wrong and provides the appropriate message.

With Interface 1 connected the very last error call is indirect to the address in the register pair at 23735 which is described as the address used to extend the Basic interpreter. The register normally holds the address 496 which curtails the normal ROM error checking routines with a message and line syntax marker.

To create a new command we just change this address and write our own routine, I really mean copy an existing routine and add a few small changes but it sounds better expressed the first way.

In writing our routine we are using a system where the new shadow ROM built into the interface is paged in, we can not therefore make calls to the old ROM routines using the format:

CALL NN 205 × y

instead we simply change the 205 to 215 i.e.,

CALL NN 215 × y

This acts like a call but to the old ROM. Remember this will only apply with the new ROM paged in and the new ROM is only paged in if the line fails the old ROM syntax check.

To write out new command therefore simply requires a line which will fail the old ROM syntax check, allowing the user to re-direct the new ROM end of error check vector

(continued on page 139)

DUSTMAN!

Meet Alf, the Dustman. Not any ordinary Dustman, but a hyper-intelligent mega-dustman. He has found himself in a spot of bovver with neither bears or lawnmowers, but ton after ton of homicidal rubbish. To make things more confusing his favourite beer is in hot persuit! But there is help on the way, 'The friends of the Binless' try to assist Alf. That is just the tip of the iceberg. Amongst the twenty waves of sheer lunacy you will meet 'Jaws' the snappy scissors, 'Wocka' the hungry dot, 'People pumpers' the beating hearts, and many more crazy characters. All beautifully animated in smooth, hi-resolution graphics. Meet Alf, his friends, his enemies, and, if you are not careful, the 'Great Lid' in Dustman for the 48K ZX Spectrum.

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Please Send ______
I Enclose ______
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Address ______

(continued from page 137)

to our own routines somewhere in RAM.

The first requirement to create a paint command is to develop a command syntax that will fail the normal syntax check. PRINT * x, y, c fits the fill and can logically be used as a paint command. Where x and y define the pixel start position on the screen and c is the colour. The machine code syntax checking routine is in table 1.

Basically all the above does is step along the line and check each character or expression and separator, these items can be used in any combination so we could have used * PAINT instead of PRINT *, it is just a means of checking a non-standard command syntax.

The above syntax check will evaluate the line as it is entered, when the program is run, the final call will not exit but carry on to the following machine code routine. When it is evaluated in what is called run time.

So the line has been successfully entered, we have typed Run and the computer has reached the new command line, it carries out the above syntax check, finds everything alright and proceeds to the machine code in table 2.

In run time each expression is tested for value and if necessary a jump made to the error routine in the old ROM. One variable is put in the system variables tables and two others placed in working Z-80 registers. Using the above techniques you should be able to manipulate the data in the command expression into any system variable or Z-80 register.

In order to demonstrate the above techniques I have written a very simple paint routine and then a short Basic program to use it.

I must point out that this command resides in RAM and so will need to be loaded into memory whenever it is required. You will not be able to enter a line with the above syntax unless the command has been loaded although a program which is saved with this syntax is reloadable but not runable.

After entering the remaining paint machine code routines all that will remain is to tell the computer where to jump to in RAM if it finds a syntax error to test for new commands.

The paint routine machine code does not use subroutine calls to any code outside ROM. This makes the code a little longer but does allow it to be relocatable anywhere in RAM.

Table 1.

	* * NOP	42 42 0	This is included as a start of routine market may be needed later on.
	CALL nn	215 24 0	Get character routine in the OLD Rom. See if
	CP 'Print'	254 245	character is print
	JP N2 ERR	194 240 1	No jump to original vector address.
	CALL nn	215 32 0	Call next character routine in OLD ROM
	CP '*'	254 42	See if character is *
	JP NZ ERR2	32 10	No jump to syntax error ERR2
	CALL nn	215 32 0	Call next character routine in OLD ROM.
	CALL nn	215 130 28	Call numerical expression routine, we would want the ability to use a furction as well as a number here.
	CP","	254 44	Check for correct separator
	JP 2 NXT	40 2	Correct separator — jump
ERR2	RST 32	231	This calls the NEW ROM error routine and prints
	DEFW	0	the 0 error 'Nonsense in basic'
NXT	CALL nn	215 32 0	Get and check next expression
	CALL nn	215 130 28	
	CP','	254 44	
	JP N2 ERR2	32 244	Jump to error if it fails syntax check
	CALL nn	215 32 0	Check last expression
	CALL nn	215 130 28	
	CALL NN	205 183 5	This is a call to the NEW ROM and will exit entering the line if in syntax check, and all is correct, otherwise flagging the error.

Table 2.

	CALL nn	215 148 30	Get 'C' expression, (we are at this end of the line into the 'A' register.
	CP '8'	254 8	Check that colour is valid (anything greater 7 is an error)
	JP C NXT 2	56 5	Yes jump
ERR3	LD (IY + ERR), 10	253 54 00 10	Set error to message 10. 'Integer out of range'
N	RST 40	239	in OLD ROM
NXT2	LD E A	95	Save ink colour in E
	LD A (NN)	58 143 92	Get attributes into A and mask off old
	AND 248	230 248	ink colour
	OR E	179	Add new ink colour
	LD (NN) A	50 143 92	replace attributes.
	CALL nn	215 148 30	Get 'Y' expression into 'A'
	AND A	167	Check for zero
	JP Z ERR3	40 235	If zero call 'integer out of range' error. Errors can be caught here or in the machine code of the routine.
	LD D A	87	save 'y' in D
	PUSH DE	213	
	CALL nn	215 148 30	Get 'x' expression into A
	POP DE 209	recover 'y'	
	AND A	167	Check x for zero
	JP Z ERR3	40 226	Jump to error If zero
	LD E A	95	save 'x' in E.

	LD HL NN	33 1 1	
UP	LD B D	66	
NXTR	LD C E	75	
NXTP	PUSH –	229 213 197	
	CALL PLOT	215 229 34	! Note call to old Rom
	POP –	193 209 225	
	LD A L	125	
	ADD C	129	
	LD C A	79	
	JP 2 INV	40 15	
	PUSH –	229 213 197	
	CALL POINT	215 234	
	CALL FP-A	215 213 45	
	POP –	193 209 225	
	AND A	167	

(continued on page 140)

Program 1.
This program draws five circles and then fills parts to demonstrate the use of the new command.

```
10 INK 0: PAPER 7:
   BORDER 7: CLS
20 CIRCLE 128,54,50
22 CIRCLE 55,54,50
24 CIRCLE 200,54,50
26 CIRCLE 92,121,50
28 CIRCLE 164,121,50
29 PRINT *128,90,0
31 PRINT *164,120,1
32 PRINT *92,120,1
35 PRINT *46,80,2
50 PRINT *211,80,2
60 PRINT *92,84,0
65 PRINT *164,82,0
70 PRINT *128,50,4
```

(continued from page 139)

```
     JP Z NXTP     40           227
INV  XOR A         175
     SUB L         149
     LD L A        111
     CP '1         254 1
     JP N2 NXTR    32 219
     LD A W        124
     ADD B         128
     LD B A        71
     JP Z NXTC     40 22
     CP '175'      254 175
     JP C NXTC     40 18
     LD I '1'      46 1
     LD C E        75
     PUSH -        229 213 197
     CALL POINT    215 206 34 !
     CALL FP-A     215 213 45 !
     AND A         167
     JP Z NXTR     40 192
NXTC XORA          175
     SUB H         148
     LD H A        103
     CP 1          254 1
     JP N2 UP      32 184
     JP END        195 193 5    Exit
                                Runtime.
```

Program 2.
9981 Calculate previous value of RAMtop (rt) decrease by 171 to a new RAMtop (nt). Reset all variables deleted by clear. Check to see if RAMtop has previously been lowered if it has and by a new command routine — redirect the vector jump address in previous command routine and jump to 9933.
9932 Redirect vector jump address in system variables.
9933 load machine code in Data statements above RAMtop.

```
9931 DEF FN t(s)=PEEK s+256*PEEK (s+1):
LET s=23730: LET nt=FN t(s)-171: CLEAR n
t: RESTORE 9934: LET s=23730: LET nt=FN
t(s): LET rt=nt+171: LET h=INT (nt/256):
 LET l=nt-256*h: IF rt<=FN t(s+2)-2 THEN
  IF PEEK (rt+2)=42 AND PEEK (rt+3)=42 T
HEN  POKE (rt+10),l: POKE (rt+11),h: GO
TO 9933
9932 POKE 23736,h: POKE 23735,l+4
9933 POKE (s+1),h: POKE s,l: FOR a=1 TO
171: READ d: POKE (nt+a),d: NEXT a: RETU
RN
9934 DATA 42,42,0,215,24,0,254,245,194,2
40,1,215,32,0,254,42,32,10,215,32,0,215,
130,28,254,44,40,2,231,00,215,32,0,215,1
30,28,254,44,32,244,215,32,0,215,130,28,
205,183,5
9935 DATA 215,148,30,254,8,56,5,253,54,0
0,10,239,95,58,143,92,230,248,179,50,143
,92,215,148,30,167,40,235,87,213,215,148
,30,209,167,40,226,95
9936 DATA 33,1,1,66,75,229,213,197,215,2
29,34,193,209,225,125,129,79,40,15,229,2
13,197,215,206,34,215,213,45,193,209,225
,167,40,227,175,149,111,254,1,32,219
9938 DATA 124,128,71,40,22,254,175,48,18
,46,1,75,229,213,197,215,205,34,215,213,
45,193,209,225,167,40,192,175,148,103,25
4,1,32,184,195,193,5
9939 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0
```

Joining programs 1 and 2 and adding line 1:

1 GOSUB 9931

will run the whole program. The reader may prefer to load the paint routine permanently above RAMtop as one of a series of utilities set up by the Run command from drive 1 as yet I am unsure of the best way to handle the required routines.

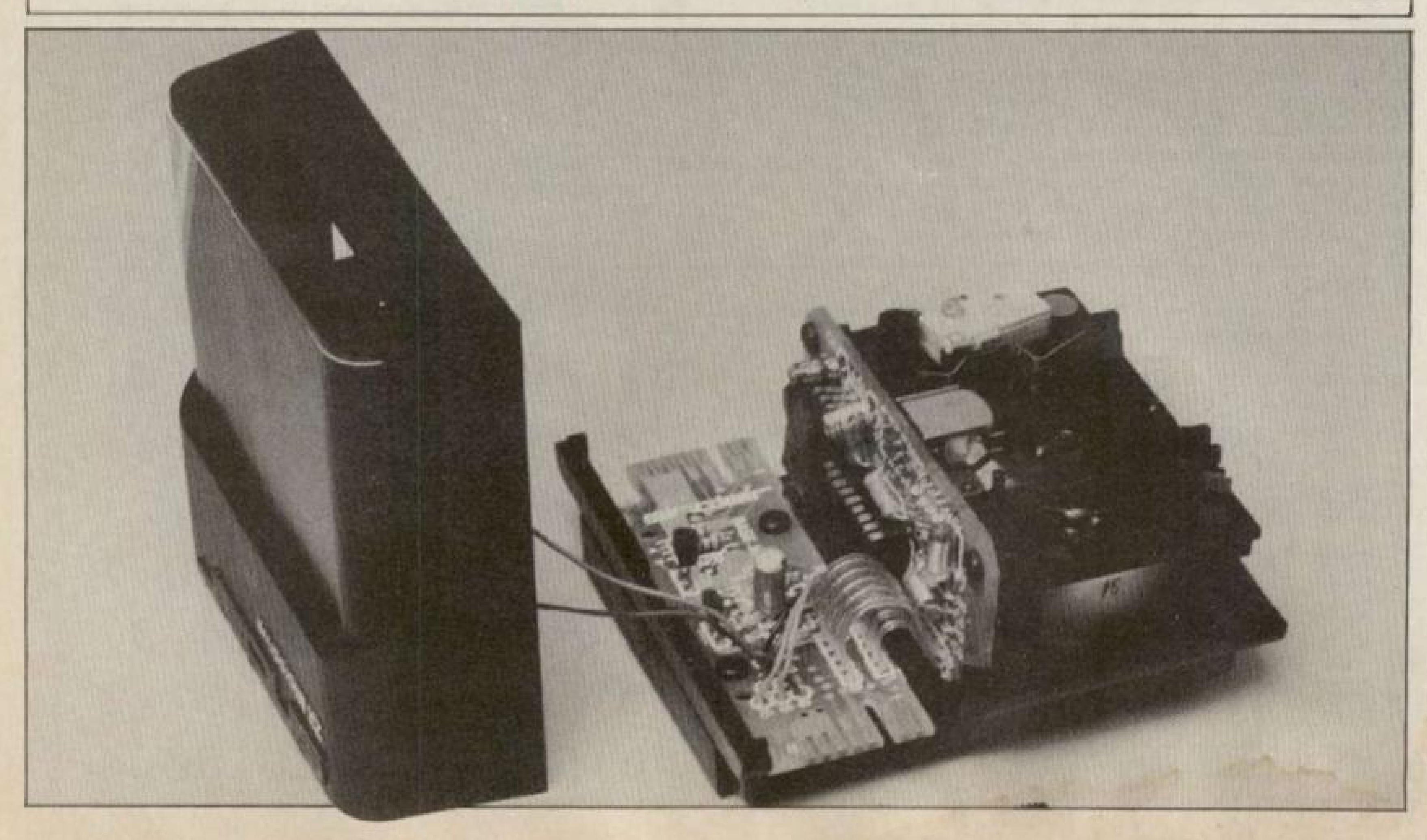
*It may well be that the following is a more logical format as all * commands are easily read in a listing.*

Perhaps * F X, Y, c	Fill starting at x y pixel with colour c.
* R, s	Renumber with steps of s.
* M, N	Disassemble from address n.
*B, a$	Back up program a$ onto cassette tape.
*E	Explosion

To get an idea of the ease with which the format can be changed the syntax check held in data statement line 9934 can be altered as follows:

Change the 245(print) to 42 (*) at the end of the 1st and beginning of 2nd line of Data.
Change the 42 (*) to 70 (F two thirds across the 2nd line down.

Now type
GOSUB 9934.
and the syntax for fill is now:
*F x,y,c
change lines 29 to 70 to the new syntax and Run the program. As they say "that's all there is to it". ■



MACBASIC



Malcolm Phillips describes a useful utility program for your CBM-64.

THIS BASIC PROGRAM lets you change the contents of the CBM-64 memory into Basic data statements. These can then be used in your own programs. The program has a number of options one of which is to rub itself out leaving just the data statements for your Basic program. This lets you add machine-code routines to your program to speed up the Basic by a factor of anywhere between 10 and 100 times.

There are a number of programs on the market which draw spirtes or create special characters etc. Some of these programs require that you run the utility program with your program thus limiting the space for your program. If you use Run/Stop/Restore then type New and load MacBasic then you can capture any of the CBM-64 memory and convert it into data statements.

You can keep doing this as many times as you like, until you have picked up all the machine code and sprites you require.

The CBM-64 has a much neglected feature which is extremely powerful — the 10 character keyboard buffer. This feature lets a program alter itself. MacBasic uses this feature by Peeking into the CBM-64 memory and converting the bytes of machine code into integers. These are sent to the top line of the screen together with a line number, the characters data and the appropriate commas.

This leaves a data statement on the top two lines of the screen. The program then sends a series of keyboard edit codes to the keyboard buffer. This is located in memory at 631-640. The number of keystrokes is at address 198. The program MacBasic runs, stops, edits, and then restarts itself, when the keyboard buffer commands are obeyed, into the Basic program. The final statement in the keyboard buffer is a Run command.

The program thus restarts itself having been suitably edited by the Data statement which was on the top line of the screen. You can use this technique to generate any line of instructions you like and edit the instruction into the program. The program MacBasic has a delete option which issues just a line number and restarts itself. This causes that line to be deleted. It also has options to convert sprites into data statements.

Sprites are normally held in the memory starting at location 12288 for sprite 0. The program has an option which deletes the MacBasic itself. If you watch the program run you will see it generate the numbers 0 to 216. These lines of code are being deleted to leave just your data statements. You can now Save your program.

The MacBasic is deliberately written without comments and on consecutive lines so that it can delete itself as fast as possible when you are ready.

Use, say, a sprite editor or assembler to create sprite or machine code, or type the example given below. Stop the sprite editor or assembler and type

RUN/STOP/RESTORE

and

NEW

Now load MacBasic in the usual way. Run MacBasic and you will see a set of options displayed. If you wish to convert say sprite O into data, select option 2. This lets you enter the sprite number and the number of sprites to be converted, followed by the statement number for the data which will end up in your program.

Remember that as you create more and more data statements you are eating away at the available memory. Your best bet is to create eight sprites at a time and Save these independently in your program. You can convert all the data you need into data statements and make up a Load routine. This will enable you to load all the data separately

(continued on page 145)

Figure 2.

```
300 PRINT"
(CLR)"
310 FORI=0TO63:READX:POKE12288+I,X:NEXT
320 FORI=0TO1023:READX:POKE53248+I,X:NEXT
330 FORX=0TO255:POKE53248,X
340 POKE53249,X/2:NEXT:GOTO330
350 END
1000 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0, 0
1001 DATA0,0,0,0,192,0,0,192,0,0,255,7,0,255, 255
1002 DATA255,255,255,192,0,0,0,0,0,0,0,0,0,0, 0
1003 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0, 62
2000 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2001 DATA0,27,35,26,0,1,200,0,21,115,240,0,0,0,0, 0
2002 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2003 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2004 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2005 DATA0,27,49,26,0,1,200,0,21,115,240,0,0,0,0, 0
2006 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2007 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2008 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2009 DATA0,155,138,26,0,1,200,0,21,115,240,0,0,0,0, 0
2010 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2011 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2012 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2013 DATA0,27,99,26,0,1,200,0,21,115,240,0,0,0,0, 0
2014 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2015 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2016 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2017 DATA0,27,48,26,0,1,200,0,21,115,240,0,0,0,0, 0
2018 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2019 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2020 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2021 DATA0,27,182,26,0,1,200,0,21,115,240,0,0,0,0, 0
2022 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2023 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2024 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2025 DATA0,27,18,26,0,1,200,0,21,115,240,0,0,0,0, 0
2026 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2027 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2028 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2029 DATA0,27,3,26,0,1,200,0,21,115,240,0,0,0,0, 0
2030 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2031 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2032 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2033 DATA0,27,4,26,0,1,200,0,21,115,240,0,0,0,0, 0
2034 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2035 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2036 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2037 DATA0,27,251,26,0,1,200,0,21,115,240,0,0,0,0, 0
2038 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2039 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2040 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2041 DATA0,27,245,26,0,1,200,0,21,115,240,0,0,0,0, 0
2042 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2043 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2044 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2045 DATA0,155,129,26,0,1,200,0,21,115,240,0,0,0,0, 0
2046 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2047 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2048 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2049 DATA0,27,27,26,0,1,200,0,21,115,240,0,0,0,0, 0
2050 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2051 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2052 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2053 DATA0,27,46,26,0,1,200,0,21,115,240,0,0,0,0, 0
2054 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2055 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2056 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2057 DATA0,27,190,26,0,1,200,0,21,115,240,0,0,0,0, 0
2058 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2059 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255, 255
2060 DATA212,106,0,0,0,0,0,0,0,0,0,0,0,0, 0
2061 DATA0,27,28,26,0,1,200,0,21,115,240,0,0,0,0, 0
2062 DATA253,241,241,242,243,244,240,240,242,243,244,245,246,247,252, 255
2063 DATA255,255,255,255,255,255,255,255,255,255,255,255,255,255,255,
READY.
```

Figure 1. A simple sprite at 12288.

```
10 PRINT"
(CLR)":POKE53280,13:POKE53281,1
20 REM SET UP SPRITE CONTROL
30 R=53248:REM REF TO GRAPHIC CHIP
40 POKE R+21,1:POKER+39,0:REM SPRITE 0
50 POKE 2040,192:REM SPRITE 0 AT 12288
60 FOR N=0TO 62:POKE 12288+N,0  :NEXT:REM CLEAR DOWN SPRITE
70 POKE 12315,255:POKE12316,7
80 POKE 12318,255:POKE 12319,255
90 POKE 12320,255:POKE 12321,255
100 POKE12322,255:POKE12323,192:POKE 12309,192:POKE12312,192
110 FOR X=0 TO 255
120 POKE R,X:REM X COORDINATE
130 POKE R+1,X/2:REM Y COORDINATE
140 NEXT X:GOTO110
150 END
```

(continued from page 143)

before entering and running your program.

Type in the MacBasic program and Save it. Keep this as a clean copy. When you load MacBasic as described earlier Save it with your own code until you are satisfied that you have finished creating and editing sprites etc. It is a good idea to start your own program at say line 300. Alter line 1 to say Run 300, so that when you are testing your own program you jump past the MacBasic.

If you need more sprites or machine code then use Run 2 to get the MacBasic utilities. When your testing is complete use the final option to delete the MacBasic as described above. Remember you can convert the sprite control codes into data also. Use option 3 and convert 53248 to 54271 into data statements.

If you have keyed the example — figure 1 — correctly you should have a simple sprite flying across the screen from top left to centre right. You can use MacBasic to do the same thing with automatically generated data statements. You can also convert the sprite control area into data.

The following proceedure shows hcw to covert sprites or areas of the CBM-64 memory into data in your own program. Figure 2 is a listing of the final program which produces the same result as the above program.

Care should be taken when loading a new program if the previous program ran with sprites. If a load error message is displayed then it will be necessary to use Run/Stop/Restore before loading the next program. This will turn off the sprites.

Save the figure 1 as a reference if you wish. Type

RUN/STOP

and

NEW

so that the sprite is still displayed, otherwise you will have to turn the sprite on in figure 2.

Your first program to key in should be MacBasic. Save a clean copy of MacBasic as it has a number of uses which result in data being added to the initial program.

Load MacBasic and use option 2 to convert sprite O to data. Enter O for the sprite and 1 for the number of sprites. Enter 1000 for the start of the data. MacBasic will generate four lines of data which describe the simple sprite.

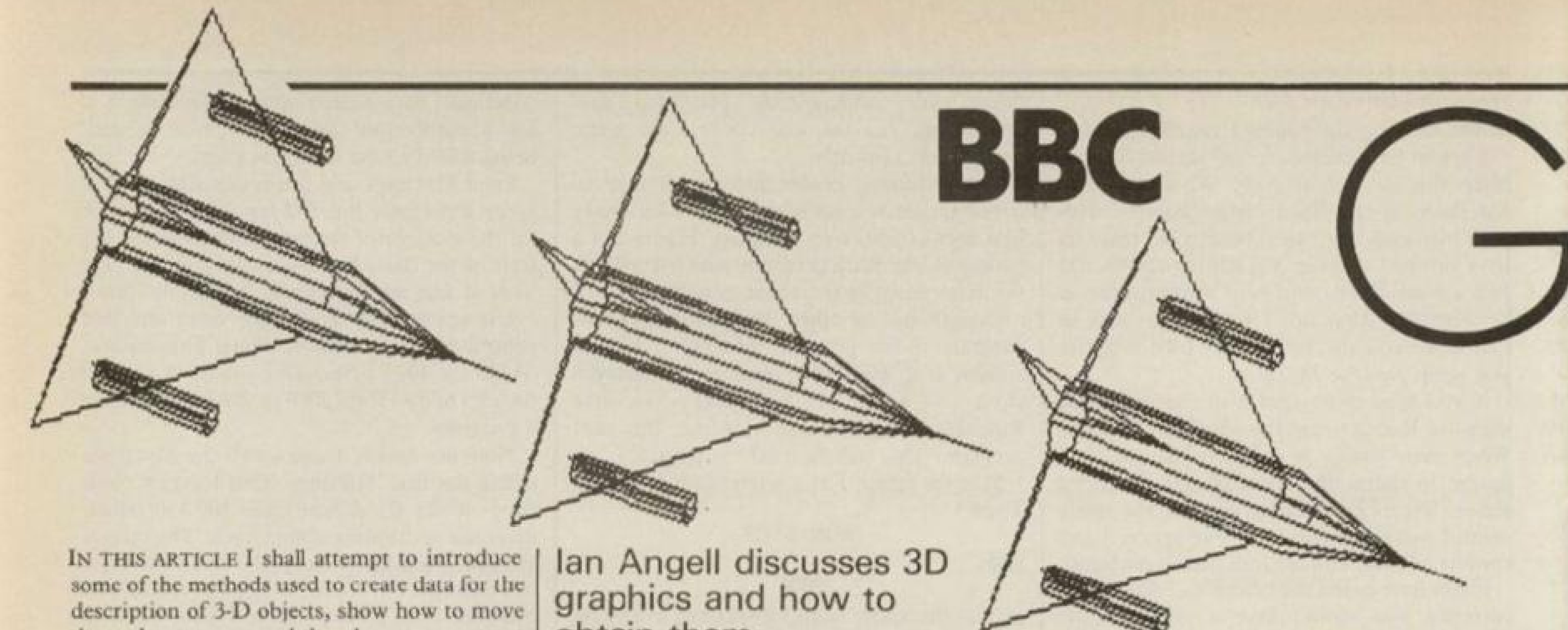
Use option 3 to convert the video interface control data into data statements. This starts at 53248 for 1023 bytes. This produces another 64 lines of data from 2000 to 2063 in the figure 2 program.

Now use option 7 and watch the MacBasic delete the first 216 lines. This leaves a clean copy of the data. Add lines 300-350 which drive the sprite around the screen. The second example program — figure 2 — seems large in this example but if you have lots of sprites and machine code to use you will soon see that MacBasic can be the starting point and workhorse for many programs.

MacBasic listing.

```
1 REM GOTO 300 OR START OF YOUR PROGRAM     ** CONVERT MEMORY TO BASIC DATA **
2 POKE53281,1:POKE53280,13
3 DIMZ%(64)
4 PRINT"
(CLR)";GOSUB 200:REM BORDER
5 PRINTSPC(1)"
(CUR DN)(CUR DN)(BLU)          OPTIONS AVAILABLE"
6 PRINTSPC(1)"          ******************":PRINT"
(CUR DN)"
7 PRINTSPC(1)"  INSTRUCTIONS ON USE................1":PRINT
8 PRINTSPC(1)"  SAVE SPRITES AS DATA...............2":PRINT
9 PRINTSPC(1)"  SAVE MACHINE CODE AS DATA..........3":PRINT
10 PRINTSPC(1)"  DELETE DATA STATEMENTS............4":PRINT
11 PRINTSPC(1)"  LIST STATEMENTS TO TAPE...........5":PRINT
12 PRINTSPC(1)"  ASSEMBLE DATA FROM TAPE...........6":PRINT
13 PRINTSPC(1)"  DELETE STATEMENTS 0-255...........7":PRINT:PRINT
14 PRINTSPC(1)"
(RVS ON)KEY IN DESIRED OPTION(RVS OFF)"
15 GETK$:IFK$=""THEN15
16 IFVAL(K$)<=0ORVAL(K$)>7THENPRINT"
(CUR UP)(CUR UP)":GOTO14
17 ON VAL(K$)GOSUB20,40,50,60,120,130,70
18 IFVAL(K$)=8THENSTOP
19 END
20 PRINT"
(CLR)":GOSUB200:PRINT"(CUR DN)(CUR DN)(CUR DN)(CUR RT)(CUR RT)(CUR RT)INSTRUCTIO
NS ON USE OF UTILITY"
21 PRINTSPC(1)"    ?????????????????????????????"
22 PRINTSPC(1)",SPRITES ARE SAVED AS DATA STATEMENTS."
23 PRINTSPC(1)" SPRITES 0-47 RAM ADDRESS 12288-15360 "
24 PRINTSPC(1)",OR MACHINE CODE CAN BE SAVED AS DATA,"
25 PRINTSPC(1)",DATA STATEMENTS CAN BE DELETED."
26 PRINTSPC(1)",THE REST OF THIS PROGRAM MAY BE"
27 PRINTSPC(1)" DELETED IF REQUIRED.THIS LEAVES ONLY"
28 PRINTSPC(1)" DATA STATEMENTS FOR USER PROGRAMS"
29 PRINTSPC(1)"
(CUR DN)(CUR DN)(RVS ON)  TO CREATE NEW PROGRAM  (RVS OFF)"
30 PRINTSPC(1)"
(CUR DN)  WAIT FOR READY TO STOP FLASHING  "
31 PRINTSPC(1)" IN THIS MODE,THEN SAVE DATA TAPE."
32 PRINTSPC(1)" LOAD NEW DATA AND KEY IN PROGRAM."
33 PRINTSPC(1)"
(CUR DN)(CUR DN)(RVS ON) ANY KEY TO CONTINUE(RVS OFF)"
37 GETK$:IFK$=""THEN37
38 GOTO4
40 PRINT"
(CLR)(CUR DN)(CUR DN)(CUR DN)(CUR DN)         SPRITES 0-47":GOSUB200
41 PRINTSPC(4)"
(RVS ON)FIRST SPRITE NO. (RVS OFF)";:N=0:GOSUB75:S9=N:IFS9>47ORS9<0THEN41
42 PRINTSPC(1)"
(CUR DN)(CUR DN) FOR CONSECUTIVE SPRITES":PRINTSPC(4)"    (RVS ON)    NO.OF SPRI
TES(RVS OFF)";
43 N=0:GOSUB75:S3=N:IF(48-S9-S3)<0ORS3<1THEN42
44 PRINTSPC(1)"
(CUR DN)(CUR DN) DATA STATEMENTS > 299":N=0
45 PRINTSPC(1)"
(RVS ON) START OF DATA(RVS OFF)";:GOSUB75:D0=N:IFN<300THEN44
46 S=12288+64*S9:S6=INT(S/256):S7=INT(S-S6*256):S3=S3*64:OP=0:POKE828,0
47 E=0:POKE829,0:S8=INT(S3/256):S9=INT(S3-S8*256)
48 POKE830,S8:POKE831,S9:D8=INT(D0/256):D9=INT(D0-D8*256):POKE832,D8
49 POKE833,D9:POKE834,S6:POKE835,S7:GOSUB80:GOTO4
50 PRINT"
(CLR)(CUR DN)(CUR DN)(CUR DN)(CUR DN)         RAM TO DATA ":GOSUB200
51 PRINTSPC(4)"
(RVS ON)START ADDRESS    (RVS OFF)";:N=0:GOSUB75:S9=N
52 PRINTSPC(1)"
(CUR DN)(CUR DN) CONSECUTIVE ADDRESSES  ":PRINTSPC(4)"    (RVS ON)NO.OF ADDRESSE
S  (RVS OFF)";
53 N=0:GOSUB75:S3=N
54 PRINTSPC(1)"
(CUR DN)(CUR DN) DATA STATEMENTS > 299":N=0
55 PRINTSPC(1)"
(RVS ON) START OF DATA(RVS OFF)";:GOSUB75:D0=N:IFN<300THEN54
56 S=S9:S6=INT(S/256):S7=INT(S-S6*256):OP=0:POKE828,0:E=0:POKE829,0
57 S8=INT(S3/256):S9=INT(S3-S8*256)
58 POKE830,S8:POKE831,S9:D8=INT(D0/256):D9=INT(D0-D8*256):POKE832,D8
59 POKE833,D9:POKE834,S6:POKE835,S7:GOSUB80:GOTO4
60 PRINT"
(CLR)(CUR DN)(CUR DN)(CUR DN)(CUR DN)         DELETE DATA ":GOSUB200
61 PRINTSPC(4)"
(RVS ON)START DATA >299  (RVS OFF)";:N=0:GOSUB75:D0=N:IFN<300THEN60
62 PRINTSPC(1)"
(CUR DN)(CUR DN) CONSECUTIVE STATEMENTS ":PRINTSPC(4)"    (RVS ON)NO.OF STATEMEN
TS (RVS OFF)";
63 N=0:GOSUB75:S3=N
64 S=0:S6=INT(S/256):S7=INT(S-S6*256):OP=1:POKE828,OP:E=0:POKE829,0
65 S8=INT(S3/256):S9=INT(S3-S8*256)
66 POKE830,S8:POKE831,S9:D8=INT(D0/256):D9=INT(D0-D8*256):POKE832,D8
67 POKE833,D9:POKE834,S6:POKE835,S7:GOSUB80:GOTO4
70 POKE839,0:PRINT"
(CLR)":GOSUB200:PRINTSPC(1)"(CUR DN)(CUR DN) REMEMBER THIS OPTION DELETES THIS"
71 PRINTSPC(1)" PROGRAM AND LEAVES YOUR STATEMENTS"
72 PRINTSPC(1)" ASSEMBLED ABOVE 299.
(CUR DN)(CUR DN)(CUR DN)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)
(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(CUR L)(RVS ON)AN
Y KEY TO CONTINUE(RVS OFF)"
73 GETK$:IFK$=""THEN73
74 GOTO210
75 NN=0
76 GETK$:IFK$=""THEN76
77 IFK$=CHR$(20)THENNN=0:FORU=1TONN:PRINT"
(CUR L) (CUR L)";:NEXTU:GOTO75
78 NN=NN+1:PRINTK$;:IFK$=CHR$(13)THENRETURN
79 N=N*10+VAL(K$):GOTO76
80 REM ***MAIN ROUTINE***
81 REM*S=START RAM **D=START DATA**
82 S4=0:POKE836,S4:S5=0:POKE837,S5:REM******S3=NO OF RAMS**D1=NO OF LINES***
83 OP=PEEK(828):S8=PEEK(830):S9=PEEK(831):D8=PEEK(832):E9=PEEK(833)
84 S6=PEEK(834):S7=PEEK(835):S4=PEEK(836):S5=PEEK(837):T=S4*256+S5:S3=S8*256+S9
85 P=INT(T/64):Q=INT(T-P*64):B=INT(Q/16):R=INT(Q-B*16):D0=D8*256+D9
86 X=D0:Y=1:V=832:W=833:GOSUB205
87 S3=S8*256+S9:D0=D8*256+D9:S=S6*256+S7:X=S:Y=0:V=834:W=835:GOSUB205
88 FORI=0TO63:Z%(I)=PEEK(S+I):NEXTI
89 IFB<3THEN91
90 X=S:Y=64:V=834:W=835:GOSUB205:REM********ADD 64 TO S
91 PRINT"
(CLR)";:PRINT"(HOME)"D0;:IFOP<>0THENOP=OP+1:POKE828,OP:GOTO97
92 PRINT"
(CUR L)DATA";
93 FORJ=0TO14:A$=STR$(Z%(J+B*16)):A$=RIGHT$(A$,LEN(A$)-1):PRINTA$",";:T=T+1
94 IFT>=S3THEN:POKE829,1:PRINT:GOTO110
95 NEXTJ:T=T+1:A$=STR$(Z%(B*16+15)):PRINTA$:IFT>=S3THENPOKE829,1:PRINT:GOTO110
96 GOTO110
97 IFOP>S3THENE=1:POKE829,E
98 PRINT:GOTO110
100 DIMZ%(64)
101 E=PEEK(829):IFE=0THEN 87
102 GOTO 4
110 X=T:Y=0:V=836:W=837:GOSUB205
111 PRINT"RUN 100:"D
112 POKE631,19:POKE632,13:POKE633,13:POKE634,13:POKE635,13:POKE198,5
113 END
120 PRINT"
(CLR)(CUR DN)(CUR DN)(CUR DN)(CUR DN)  LIST PROGRAM TO TAPE ":GOSUB200
121 PRINTSPC(4)"
(RVS ON)START LINE NO.    (RVS OFF)";:N=0:GOSUB75:S9=N
122 PRINTSPC(1)"
(CUR DN)(CUR DN) LIST PROGRAM TO ONLY  ":PRINTSPC(4)"    (RVS ON)FINAL LINE NO.
  (RVS OFF)";
123 N=0:GOSUB75:S3=N
124 INPUT"
(CLR)(CUR DN)(CUR DN)(CUR DN)(CUR DN)  (RVS ON)TAPE TITLE   (RVS OFF)";NF$
125 PRINTCHR$(147):PRINT"
(HOME)OPEN1,1,1,NF$:CMD 1:LIST";S9;"-";S3
126 PRINT"
(CUR DN)(CUR DN)PRINT#1:CLOSE 1:GOTO129"
127 POKE631,19:FORI9=0TO6:POKE632+I9,13:NEXTI9:POKE198,4
128 END
129 GOTO4
130 PRINT"
(CLR)(CUR DN)(CUR DN)(CUR DN)(CUR DN)  READ PROGRAM FROM TAPE "
131 INPUT"
(CUR DN)(CUR DN)  (RVS ON)TAPE TITLE   (RVS OFF)";NF$
132 OPEN1,1,0,NF$:K=0:K9=0:K8=0
134 PRINT"
(CLR)(HOME)"
135 GET#1,Y$:Y=ASC(Y$+CHR$(0)):POKE20000+K,Y
136 IFST=64THENCLOSE 1:FORL=1TO4:POKE20000+K+L,0:NEXTL:GOTO140
138 PRINTY$;:K=K+1:GOTO135
140 K=0
141 PRINT"
(CLR)(HOME)";
142 Y=PEEK(20000+K):IFY=0ORY=10THEN2
143 Y$=CHR$(Y):K=K+1:K9=INT(K/256):K8=INT(K-K9*256):POKE820,K9:POKE821,K8
144 IFY$=CHR$(13)THEN147
145 PRINTY$;:GOTO142
147 PRINT:PRINT"RUN 150:REM PLEASE WAIT "
148 POKE631,19:FORI=0TO4:POKE632+I,13:NEXT:POKE198,5
149 END
150 K9=PEEK(820):K8=PEEK(821):K=K9*256+K8:PRINT"
(CLR)"
153 GOTO142
200 S0=1024:C0=40:B0=54272:FORC1=0TO39:S1=S0+C1:S2=S0+C1+C0*24:GOSUB202:NEXTC1
201 FORC1=1TO23:S1=S0+C0*C1:S2=S0+C0*C1+39:GOSUB202:NEXTC1:RETURN
202 POKES2,214:POKES2+B0,5:POKES1,214:POKES1+B0,5:RETURN
205 X=X+Y:X8=INT(X/256):X9=INT(X-X8*256):POKEV,X8:POKEW,X9:RETURN
210 I=PEEK(839):PRINT"
(CLR)":IFI>206THEN214
211 PRINT"
(CLR)"I:I=I+1:POKE839,I:PRINT"RUN 210:REM WAIT FOR CLEAR SCREEN"
212 POKE631,19:POKE632,13:POKE633,13:POKE634,13:POKE635,13:POKE198,5
213 END
214 FOR I=210TO216:PRINTI:NEXT:PRINT"PRINTCHR$(147)"
215 POKE631,19:FORI=1TO9:POKE631+I,13:NEXT:POKE198,12
216 END

READY.
```



Ian Angell discusses 3D graphics and how to obtain them.

IN THIS ARTICLE I shall attempt to introduce some of the methods used to create data for the description of 3-D objects, show how to move them about space, and then how to construct line-drawings of 3-D scenes on a microcomputer screen.

This article will describe a step by step approach to the construction of a group of three-dimensional objects which can then be moved and rotated into any position in space, and the whole scene can be viewed from any position and then drawn on the screen of a BBC Model B microcomputer. Listing 1 draws a simple scene consisting of two cubes viewed from a fixed position.

Microcomputer screens are a rectangular matrix of dots or pixels. On the BBC Model B it is possible to identify a particular dot by giving its position as the number of dots from the left hand edge of the screen together with the number of dots from the bottom edge. Note that some machines count down from top edge, for example the IBM personal computer. This pair of integers is the so-called pixel vector. The term vector will appear over and over again in any serious study of computer graphics, so it is just as well that we understand it straight away.

A two-dimensional vector is simply a pair of numbers or co-ordinates, usually written inside brackets. A vector normally represents a point, and the co-ordinates refer to the distances of that point from mutually perpendicular axes.

For example the two-dimensional pixel vector (i,j) describes a pixel which is i dots from the left hand edge and j dots above the bottom of the screen. The axes in this case are the left hand and bottom edges of the screen respectively. Note that the order of the co-ordinates is important, with a pixel vector the first co-ordiante counts across the screen and the second up it: if i≠j then the vector (i,j) is not the same as (j,i). Strictly speaking, the number of pixels on the BBC micro is mode-dependant, but we will conveniently ignore this fact and consider the screen of addressable points, namely 1280 across by 1024 down, and call these pixels.

Each graphics microcomputer has a series of instructions for drawing on the screen. For example,

MOVE i,j

on the BBC micro positions an imaginary plotting pen over the pixel (i,j).

DRAW i,j

draws a line with this pen from the previous pixel to pixel (i,j). A triangle of pixels can be filled-in by first moving to two (pixel) vertices of the triangle, and then using PLOT 69,i,j, where (i,j) is the third vertex.

This is all very well but when we construct a data base relating to real objects it is essential that their dimensions to be given in real-world units of measurement — for example centimetres or miles — and not in pixels. So our first task is to relate general real-world two-dimensional veectors, (x,y) say, to corresponding pixel vectors (i,j) on the screen. Initially we divide the BBC micro screen into a text window of two text lines at the top of the screen for communications, and a graphics frame of 1280 points across by 960 up, a rectangle with sides in the ratio 4:3.

If we think of this graphics area as a window on the real-world of size horizontal by vertical — measured in real units with Horiz:Vert = 4:3 — then we can construct functions FNX and FNY to scale reeal (x,y) vectors into their respective pixel vector equivalents.

Naturally the co-ordinates of a real vector have to be measured relative to some set of mutually perpendicular co-ordinate axes, and some arbitrary origin where these axes intersect. The origin divides each axis into two halves, a positive side and a negative side.

These axes are usually called x- and y-axes. We normally identify the origin with a pixel somewhere in the middle of the screen, the positive x-axis horizontal and to the right, and the poxitive y-axis vertical and above the origin. Given this co-ordinate system and the real dimensions of the window, we can write procedures — see listing 1 — which initialise all the scaling factors, variables and necessary foreground and background colours — start — and move the origin of the space co-ordinates

Listing 1.

```
100REM" MAIN PROGRAM
110INPUT"WHICH MODE"MODE : MODE MODE
120INPUT"HORIZ",HORIZ : VERT=3*HORIZ/4
130PROCstart(3,0)
140PROCsetorigin(HORIZ/2,VERT/2)
150PROCscene3
160END
6000REM" scene3 / consisting of
   2 similar objects
6010DEF PROCscene3
6020DIM X(24),Y(24),Z(24),XD(24),YD(24)
6030DIM LIN(2,60),A(4,4),B(4,4),R(4,4)
6040NOV=0 : NOL=0
6050PROCidR3 : PROCobject
6060PROCidR3
6070PROCrot3(PI/5,1) : PROCmult3
6080PROCrot3(PI/6,2) : PROCmult3
6090PROCtran3(3,2,2) : PROCmult3
6100PROCobject
6110PROCidR3 : PROClook3
6120PROCdrawit
6130ENDPROC
6500REM" object / add to data base
6510DEF PROCobject
6520LOCAL I%,XX,YY,ZZ,L1,L2
6530DATA 1,2, 2,3, 3,4, 4,1, 5,6, 6,7, 7,8, 8,5, 1,5,
2,6, 3,7, 4,8
6540DATA 1,1,1, 1,1,-1, 1,-1,-1, 1,-1,1, -1,1,1, -1,1
,-1, -1,-1,-1, -1,-1,1
6550RESTORE
6560FOR I%=1 TO 12
6570READ L1,L2 : NOL=NOL+1
6580LIN(1,NOL)=L1+NOV : LIN(2,NOL)=L2+NOV
6590NEXT I%
6600FOR I%=1 TO 8
6610READ XX,YY,ZZ : NOV=NOV+1
6620X(NOV)=R(1,1)*XX+R(1,2)*YY+R(1,3)*ZZ+R(1,4)
6630Y(NOV)=R(2,1)*XX+R(2,2)*YY+R(2,3)*ZZ+R(2,4)
6640Z(NOV)=R(3,1)*XX+R(3,2)*YY+R(3,3)*ZZ+R(3,4)
6650NEXT I%
6660ENDPROC
7000REM" drawit
7010DEF PROCdrawit
7020LOCAL I%,L1,L2 : CLG
7030FOR I%=1 TO NOV
7040XD(I%)=R(1,1)*X(I%)+R(1,2)*Y(I%)+R(1,3)*Z(I%)+R(1
,4)
7050YD(I%)=R(2,1)*X(I%)+R(2,2)*Y(I%)+R(2,3)*Z(I%)+R(2
,4)
7060NEXT I%
7070FOR I%=1 TO NOL
7080L1=LIN(1,I%) : L2=LIN(2,I%)
7090PROCmoveto(XD(L1),YD(L1))
7100PROClineto(XD(L2),YD(L2))
7110NEXT I%
7120ENDPROC
8200REM" look3
8210DEF PROClook3
8220ENDPROC
8600REM" rot3
8610DEF PROCrot3(THETA,AXIS)
8620LOCAL AX1,AX2,CT,ST
8630AX1=(AXIS MOD 3)+1
8640AX2=(AX1 MOD 3)+1
8650CT=COS(THETA) : ST=SIN(THETA)
8660A(AXIS,AXIS)=1 : A(AXIS,AX1)=0 : A(AXIS,AX2)=0
8670A(AX1,AXIS)=0 : A(AX1,AX1)=CT : A(AX1,AX2)=-ST
8680A(AX2,AXIS)=0 : A(AX2,AX1)=ST : A(AX2,AX2)=CT
8690A(1,4)=0 : A(2,4)=0 : A(3,4)=0
8700A(4,1)=0 : A(4,2)=0 : A(4,3)=0 : A(4,4)=1
8710ENDPROC
9000REM" tran3
9010DEF PROCtran3(TX,TY,TZ)
9020A(1,1)=1 : A(1,2)=0 : A(1,3)=0 : A(1,4)=TX
9030A(2,1)=0 : A(2,2)=1 : A(2,3)=0 : A(2,4)=TY
9040A(3,1)=0 : A(3,2)=0 : A(3,3)=1 : A(3,4)=TZ
9050A(4,1)=0 : A(4,2)=0 : A(4,3)=0 : A(4,4)=1
9060ENDPROC
9100REM" mult3
9110DEF PROCmult3
9120LOCAL I%,J%,K%,AB
9130FOR I%=1 TO 4
9140FOR J%=1 TO 4
9150AB=0
9160FOR K%=1 TO 4
9170AB=AB+A(I%,K%)*R(K%,J%)
9180NEXT K%
9190B(I%,J%)=AB
9200NEXT J%
9210NEXT I%
9220FOR I%=1 TO 4
9230FOR J%=1 TO 4
9240R(I%,J%)=B(I%,J%)
9250NEXT J%
9260NEXT I%
9270ENDPROC
9300REM" idR3
9310DEF PROCidR3
9320R(1,1)=1 : R(1,2)=0 : R(1,3)=0 : R(1,4)=0
9330R(2,1)=0 : R(2,2)=1 : R(2,3)=0 : R(2,4)=0
9340R(3,1)=0 : R(3,2)=0 : R(3,3)=1 : R(3,4)=0
9350R(4,1)=0 : R(4,2)=0 : R(4,3)=0 : R(4,4)=1
9360ENDPROC
9400REM" lineto
9410DEF PROClineto(XPT,YPT)
9420DRAW FNX(XPT),FNY(YPT)
9430ENDPROC
9500REM" moveto
9510DEF PROCmoveto(XPT,YPT)
9520MOVE FNX(XPT),FNY(YPT)
9530ENDPROC
9600REM" setorigin
9610DEF PROCsetorigin(XMOVE,YMOVE)
9620XORIG=XORIG+XMOVE : YORIG=YORIG+YMOVE
9630PROCmoveto(0,0)
9640ENDPROC
9700REM" start
9710DEF PROCstart(B,F)
9720XORIG=0 : YORIG=0
9730NXPIX=1280 : NYPIX=960
9740XYSCALE=NXPIX/HORIZ : YSCALE=NYPIX/VERT
9750IF XYSCALE>YSCALE THEN XYSCALE=YSCALE
9760VDU28,0,1,39,0 : VDU24,0;0;1279;959;
9770GCOL 0,B+128 : CLG : GCOL 0,F
9780ENDPROC
9800REM" real-to-pixel functions
9810DEF FNX(Z)=INT((XORIG+Z)*XYSCALE+0.5)
9820DEF FNY(Z)=INT((YORIG+Z)*XYSCALE+0.5)
```

RAPHICS

Listing 2.

```
6700REM" object / add to data base
6710DEF PROCobject
6719REM" data for a ICOSAHEDRON
6720LOCAL I%,XX,YY,ZZ,L1,L2,D
6730D=(1+SQR(5))/2
6740DATA 1,2, 1,3, 1,4, 1,6, 1,8, 2,3, 2,4, 2,5, 2,9,
 3,5, 3,6, 3,7, 4,8, 4,9, 4,12, 5,7, 5,9, 5,10, 6,7, 6
,8, 6,11, 7,10, 7,11, 8,11, 8,12, 9,10, 9,12, 10,11, 1
0,12, 11,12
6750DATA 0,1,D, D,0,1, 1,D,0, 0,-1,D, D,0,-1, -1,D,0,
 0,1,-D, -D,0,1, 1,-D,0, 0,-1,-D, -D,0,-1, -1,-D,0
6760RESTORE
6769REM" store line information.
6770FOR I%=1 TO 30
6780READ L1,L2 : NOL=NOL+1
6790LIN(1,NOL)=L1+NOV : LIN(2,NOL)=L2+NOV
6800NEXT I%
6809REM" store vertex information                  put i
n position by matrix R.
6810FOR I%=1 TO 12
6820READ XX,YY,ZZ : NOV=NOV+1
6830X(NOV)=R(1,1)*XX+R(1,2)*YY+R(1,3)*ZZ+R(1,4)
6840Y(NOV)=R(2,1)*XX+R(2,2)*YY+R(2,3)*ZZ+R(2,4)
6850Z(NOV)=R(3,1)*XX+R(3,2)*YY+R(3,3)*ZZ+R(3,4)
6860NEXT I%
6870ENDPROC
```

Listing 3.

```
8200REM"look3 / maintain vertical
8210DEF PROClook3
8220LOCAL FX,FY,FZ,THETA
8230CLS : INPUT"(EX,EY,EZ)",EX,EY,EZ
8240INPUT"(DX,DY,DZ)",DX,DY,DZ
8250PROCtran3(-DX,-DY,-DZ) : PROCmult3
8260FX=EX-DX : FY=EY-DY : FZ=EZ-DZ
8270THETA=FNangle(FX,FY)
8280PROCrot3(-THETA,3) : PROCmult3
8290DIST=SQR(FX*FX+FY*FY)
8300THETA=FNangle(FZ,DIST)
8310PROCrot3(PI-THETA,2) : PROCmult3
8320DIST=SQR(DIST*DIST+FZ*FZ)
8330THETA=FNangle(DIST*FX,-FY*FZ)
8340PROCrot3(THETA,3) : PROCmult3
8350PROCtran3(0,0,DIST) : PROCmult3
8360ENDPROC
8400REM" rot3
8410DEF PROCrot3(THETA,AXIS)
8420LOCAL AX1,AX2,CT,ST
8430AX1=(AXIS MOD 3)+1
8440AX2=(AX1 MOD 3)+1
8450CT=COS(THETA)   : ST=SIN(THETA)
8460A(AXIS,AXIS)=1 : A(AXIS,AX1)=0 : A(AXIS,AX2)=0
8470A(AX1,AXIS)=0  : A(AX1,AX1)=CT : A(AX1,AX2)=-ST
8480A(AX2,AXIS)=0  : A(AX2,AX1)=ST : A(AX2,AX2)=CT
8490A(1,4)=0 : A(2,4)=0 : A(3,4)=0
8700A(4,1)=0 : A(4,2)=0 : A(4,3)=0 : A(4,4)=1
8710ENDPROC
8800REM"angle
8810DEF FNangle(AX,AY)
8820IF ABS(AX)>0.00001 THEN 8860
8830IF ABS(AY)<0.00001 THEN =0
8840IF AY<0 THEN =1.5*PI
8850=PI/2
8860IF AX<0 THEN =(ATN(AY/AX)+PI) ELSE =ATN(AY/AX)
```

about the screen — setorigin.

Originally the origin is identified with the bottom left hand corner of the screen, but with setorigin we can move it to any other pixel on or off the screen — we can imagine the pixels going off the screen to infinity in all directions.

We may also move the graphics pen to a pixel corresponding to a real vector — moveto — and draw a line between real vectors — lineto. These procedures, which relate real two-dimensional space with the rectangular matrix of pixels on a micro screen are called primitives, and will be the basis of all future constructions.

From this point on we will not refer to a pixel again: everything will be in real-world units, and device independent — within variations of different dialects of Basic. If you wish to find out more details about the construction of the procedures, and others in this article, you should read *Advanced Graphics on the BBC Model B Microcomputer* by I O Angell and B J Jones.

We now have to create a method for describing a point in 3-D Space. To do this we return to the vector: now a three-dimensional vector, which will be written as three co-ordinates inside brackets thus: (x,y,z). The three values refer to the position of that point relative to an origin and three mutually perpendicular axes. As with 2-D space, we can arbitrarily fix any point in the space and call it the co-ordinate origin — origin for short. We then imagine three mutually perpendicular lines through this point, each line goes off to inifinity in both directions.

These are the x-axis, y-axis and z-axis. Each axis is thought to have a positive and a negative half, both starting at the origin, ie, distance measured from the origin along the axis are positive on one side and negative on the other.

We may think of the x- and y-axes in a similar way to 2-D space, both lying on the page of this magazine say, the positive x-axis horizontal and to the right of the origin, and the positive y-axis vertical and above the origin. This just leaves the position of the z-axis: it has to be perpendicular to the page since it is perpendicular to both x- and y-axes. The postive z-axis can be into the page — the so-called left handed triad of axes — or out of the page — the right handed triad. We always use the left-handed triad. We always use the left-handed triad notation.

Thus every important point on our object will be uniquely described by three numbers, the x-, y- and z-co-ordinates of the point vector. So if we have NOV important vertices in a scene, then the natural approach is to place them in arrays (X(1:NOW), Y(1:NOV) and Z(1:NOV), so that the I'th vertex is given by the vector (X/I), Y(1), Z(I). The notation 1:NOV simply means we use that part of the array with index ranging from 1 to NOV.

We next have to consider line segments. Each line segment joints two vertices, which we assume are two of the above-mentioned important vertices. In order to define the line all we need do is give the indices of the two vertices at the ends of the line segment, and this line can be completely described by using the information stored in arrays X, Y and Z.

If our scene has NOL lines in total then we use the two-dimensional array

LIN(1:2, 1:NOL)

to store the vertex indices. That is the I'th line joins the two vertices with indice LIN(1,I) and LIN(2,I).

Of course, we can define the surface of an object, perhaps in terms of polygonal planar facets. These facets may be given in terms of either the vertices or the lines of the polygons. We may wish to specify the order of the vertices around each facet. In a certain type of hidden surface algorithm it is necessary to have these vertices stored in an anticlockwise order when viewed from the outside of the object. But all of this goes way beyond this article.

To introduce the whole concept of 3-D manipulation it is best to start with wire object defined by vertices and lines, and only when these are totally understood should we venture into a study of solid objects defined by vertices and facets.

One of the simplest 3-D objects is the cube. So we shall use it to introduce the ideas of transforming objects in space. A simple way to describe a cube with edge length two units is to define eight vertices.

(1,1,1), (1,1,-1), (1,-1,-1), (1,-1,1), (-1,1,1)
(-1,1,-1), (-1,-1,-1), (-1,-1,1)

which we label 1 to 8 respectively. The edges of the cube are then 12 lines which join vertices

1→2, 2→3, 3→4, 4→1, 5→6, 6→7, 7→8,
8→5, 1→5, 2→6, 3→7 and 4→5

respectively. Any such simple way we devise for constructing a given object will be called a Setup position for that object.

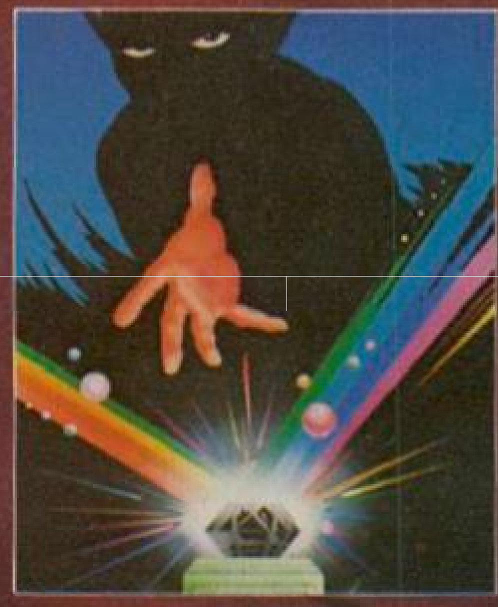
We will therefore consider our scene as a data base of vertices, X, Y and Z and lines LIN: we also use arrays XD(1:NOV) and YD(1:NOV) for drawing the object, but more

(continued on page 151)

Listing 4.

```
5000REM"genrot / rotate space about a
  general axis
5010DEF PROCgenrot(PX,PY,PZ,QX,QY,QZ,GAMMA)
5020LOCAL ALPHA,BETA
5030PROCtran3(-PX,-PY,-PZ) : PROCmult3
5040ALPHA=FNangle(QX,QY)
5050PROCrot3(-ALPHA,3) : PROCmult3
5060BETA=FNangle(QZ,SQR(QX*QX+QY*QY))
5070PROCrot3(-BETA,2) : PROCmult3
5080PROCrot3(GAMMA,3) : PROCmult3
5090PROCrot3(BETA,2) : PROCmult3
5100PROCrot3(ALPHA,3) : PROCmult3
5110PROCtran3(PX,PY,PZ) : PROCmult3
5120ENDPROC
6000REM" scene3 / consisting of
  2 similar objects
6010DEF PROCscene3
6020DIM X(24),Y(24),Z(24),XD(24),YD(24)
6030DIM LIN(2,60),A(4,4),B(4,4),R(4,4)
6040NOV=0 : NOL=0
6049REM" place first object in SETUP position
6050PROCidR3 : PROCobject
6059REM" place second object in a
peculiar position
6060PROCidR3
6070PROCrot3(PI/5,1) : PROCmult3
6080PROCrot3(PI/6,2) : PROCmult3
6090PROCtran3(3,2,2) : PROCmult3
6100PROCobject
6109REM" specify general rotation
6110PROCidR3 : CLS
6120INPUT"(PX,PY,PZ)",PX,PY,PZ
6130INPUT"(QX,QY,QZ)",QX,QY,QZ
6140INPUT"GAMMA",GAMMA
6150PROCgenrot(PX,PY,PZ,QX,QY,QZ,GAMMA)
6159REM" OBSERVED position
6160PROClook3
6169REM" draw the scene
6170PROCdrawit
6179REM" draw another picture
6180GOTO 6110
6190ENDPROC
```

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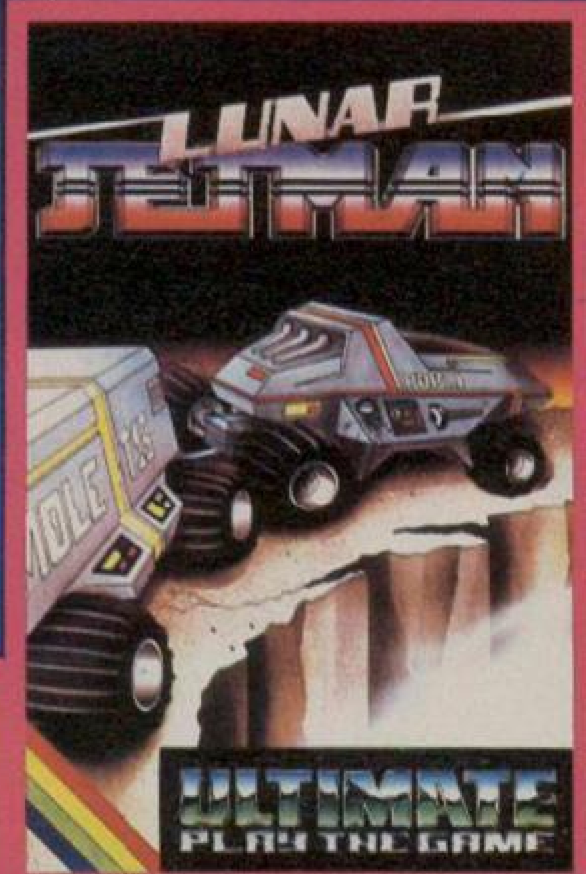
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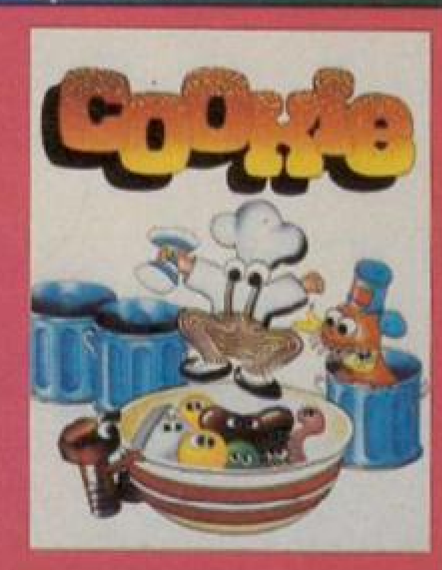


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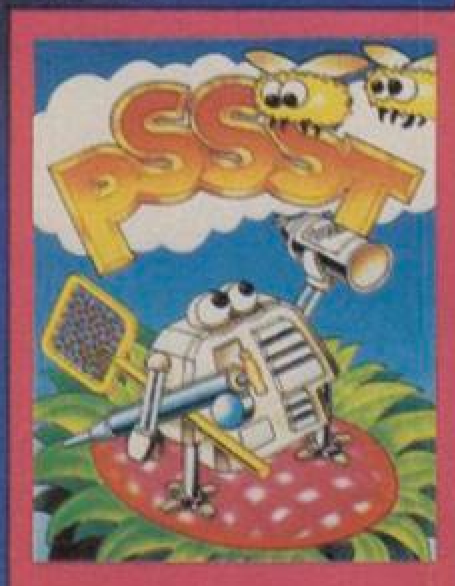
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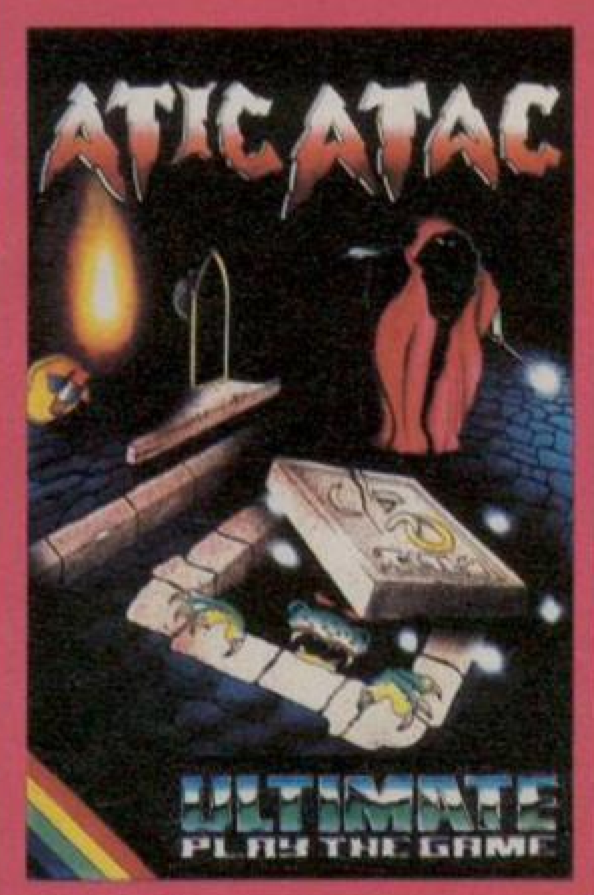


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(continued from page 147)

of these later. In order to create our scene we require procedures which will add the data for a given object to the data base. The procedure object for adding a cube to a given scene is given in listing 1. The reason for the matrix R is given in the next section.

The cube we give here is in a very simple position and orientation. It includes the origin and its edges are parallel to the co-ordinate axes. Naturally we will not necessarily want the cube to stay in this Setup position, we may wish to move it to some other position and orientation in space, what we call the Actual position. In order to relate the Setup and Actual positions we will have to move the object through space. Surprisingly this is not too difficult a task. Luckily, all realistic transformations can be broken down into combinations of three basic transformations: translation, rotation and scaling. We do not consider scaling here.

We need a method that describes a transformation which changes a vertex (x,y,z) to (x',y',z') say. There is no need to worry about lines. A line which joins two vertices before the transformation joins the same two newly-positioned vertices after the move. The same would be true for polygonal facets also. So the problem reduces to a consideration of the vertices.

All realistic transformations are known as linear transformations. That is the new and old co-ordinates of a vertex are related by three linear equations of the type given below:

$$x' = A(1,1).x + A(1,2).y + A(1,3).z + A(1,4)$$
$$y' = A(2,1).x + A(2,2).y + A(2,3).z + A(2,4)$$
$$z' = A(3,1).x + A(3,2).y + A(3,3).z + A(3,4)$$

You will recognise equations like these appearing in many parts of our listings. For convenience we add the trival extra equation:

$$1 = A(4,1).x + A(4,2).y + A(4,3).z + A(4,4)$$

where

$$A(4,1) = A(4,2) = A(4,3) = 0 \text{ and } A(4,4) = 1$$

In other words 1 = 1. Convenience, because now we can think of the transformation as the matrix of coefficients, the two-dimensional 4 by 4 array A:

$$\begin{matrix} A(1,1) & A(1,2) & A(1,3) & A(1,4) \\ A(2,1) & A(2,2) & A(2,3) & A(2,4) \\ A(4,1) & A(4,2) & A(4,3) & A(4,4) \end{matrix}$$

Another reason for using matrices is the ease with which we can combine two transformations: say we first use a transformation described by matrix R, then a second described by matrix A. The combined transformation is described by the product of two 4 by 4 matrices A×R: note the order of the matrix product A×R and not R×A.

In listing 1 we include two procedures — idR3 and mult3 — to implement these ideas. idR3 sets up a matrix R as the unit or identity matrix — ie, 0's — that is the matrix corresponding to a transformation which doesn't change space — ie, x' = x, y' = y and z' = z. mult3 multiplies matrix A by matrix R and copies the result back into R, using a matrix B to hold intermediate results.

The reason for this apparently overcomplicated procedure is that since we cannot pass arrays as parameters into a procedure, and we are likely to combine lots of transformations — ie, multiply many matrices together — then we set up matrix R so that it may be repeatedly updated by each new transformation matrix A.

Let us now look at the two types of transformation.

Suppose we translate each point (x,y,z) to (x+TX,y+TY,z+TZ), then we have the equations:

$$x' = 1.x + 0.y + 0.z + TX \qquad\qquad 100TX$$
$$y' = 0.x + 1.y + 0.zTY \qquad ie, A = 010TY$$
$$z' = 0.x + 0.y + 1.z + TZ \qquad\qquad 001TZ$$
$$1 = 0.z + 0.y + 0.z + 1 \qquad\qquad 0001$$

A procedure which creates matrix A given TX,TY and TZ is given in tran3 in listing 1. Note that this procedure creates matrix A so that mult3 can use it immediately to update matrix R.

Rotation is a little more complex. We start by defining three special rotations: by an angle θ — a variable named Theta — about a given co-ordinate axis — variable Axis. AXIS = 1 is the x-axis, AXIS = 2 the y-axis and AXIS = 3 the z-axis.

For AXIS = 1 the equations are:

$$x' = 1.x + 0.y + 0.z + 0$$
$$y' = 0.x + \cos\theta.y \;\; \sin\theta.z + 0$$
$$z' = 0.x + \sin\theta.y + \cos\theta.z + 0$$

You will find the reasons for the use of sines and cosines in any O-Level text on co-ordinate geometry.

For AXIS = 2 the equations are:

$$x' = \cos\theta.x + 0.y + \sin\theta.z + 0$$
$$y' = 0.x + 1.y + 0.z + 0$$
$$z' = \;\; \sin\theta.y + 0.y + \cos\theta.z + 0$$

and for AXIS = 3 the equations are:

$$x' = \cos\theta.z \; \sin\theta.y + 0.z + 0$$
$$y' = \sin\theta.x + \cos\theta.y + 0.z + 0$$
$$z' = 0.x + 0.y + 0.z + 0$$

These the types of rotation are programmed in listing 1 as one procedure rot3. We will consider the case of the general rotation later.

Now that we know how to create a matrix R which moves an object from its Setup position to its Actual position: simply use combinations of translations and rotations. We can use the R — the result of idR3 and repeated applications of tran3, rot3 and mult3 — in our equations to calculate the transformed co-ordinates x',y' and z', and add the data for a transformed object to our data base. The problem of creating a scene is now solved. A main program prepares the graphics screen and then calls a procedure — scene3 — in which we declare cur data base. We initially allow space for 24 vertices and 60 lines for the icosahedron. The procedure must then call various procedures for creating particular objects — such as a cube or icosahedron — using a variety of transformation matrices R to create the data base. Then it must describe where the observer is positioned in space — a call to procedure look3 — and finally draw the picture. The scene3 procedure in listing 1 creates a scene of two cubes, one remaining in the original Setup position, the other placed in an arbitrary peculiar position by rotating the Setup cube by π/5 about the x-axis, then by π/6 about the y-axis and finally translating it by (3,2,2). Here we give a trivial look3 procedure — it returns immediately — later we will consider the genral case.

Like all other aspects of computer graphics, there is never just one way to draw an object. We have to devise a method for drawing a three-dimensional object on a two-dimensional screen using our procedures moveto and lineto etc. Any method used to draw a two-dimensional view of a three-dimensional scene is called a projection. There are many, many projections. Probably the best known is the Mercator Projection which draws the surface of a sphere — the earth — on a flat rectangular area — a map.

The projection is quite complicated, involving a variety of trigonometric functions and is not really valid in this situation anyway. We will describe the most straightforward of all 3-D to 2-D projections, the orthographic. The idea is very simple. Imagine you are an observer at the origin of space, looking along the positive z-axis, what we will call the Observed position.

We ignore the z-co-ordinates of all the vertices, each three-dimensional vertex now being considered as a two-dimensional vector — defined by the x- and y-co-ordinates of the original 3-D vector — which are stored in the arrays XD and YD and can be drawn as points in our two-dimensional window — the screen — the real x- and y-axes of the screen which we created start etc. being identified with the corresponding axes in 3-D space.

The procedure drawit in listing 1, draws all the NOL lines joining the NOV vertices in our scene. Note how drawit only needs to know the form of the data base, the details of a scene are irrelevant.

So we finally have our program for drawing a 3-D scene. With all the comment's in the program, and the liberal use of spaces to make the listing readable, you will have to Load this program at PAGE = $1100 should you wish to Run in modes 0,1 or 2. Because we placed most comments on program lines ending with a 9, you can get rid of these quickly using the Rem-stripper, that is by typing AUTO 9,10 and holding down the Return key.

Try the program with HORIZ = 10, using all the graphics modes — 0, 1, 2, 4 and 5. Then try HORIZ = 5, 20, 30, 40 etc. We get the same shapes and orientation in the scene, only the scale changes. You will also note that the first cube is always drawn as a square. This

(continued on next page)

Listing 5.

```
[illegible]
```

(continued from previous page)

is because in the orthographic projection, we are looking face-on to this cube and the front and back faces are projected into the same square, and the other four faces are projected into lines in the square.

Here we will show the value of this structured approach to our program. Suppose the object procedure in listing 1 is meant to create an icosahedron instead of a cube. We simply delete lines 6500 to 6660 of the program and replace them with the object procedure in listing 2: all the other procedures stay the same.

Running with the same values mentioned above we now get a scene containing two icosahedra. As an exercise you can write your own object procedure with constructs a tetrahedron. Four Vertices (1,1,1), (1,-1,-1), (-1,1,-1) and (-1,-1,1), with six lines 1→2, 1→3, 1→4, 2→3, 2→4 and 3→4.

We now vary the position of the observer, ie, its Actual position may be placed at a general point (EX,EY,EX) say, looking towards the point (DX,DY,DZ) a change for our special situation, the Observer position where the observer is at (0,0,0) looking towards (0,0,1). The general look3 procedure referred to earlier is given in listing 3. It creates a matrix which has the effect of moving the observer from this Actual position in space to the Observer position.

This Actual to Observer matrix will again be incorporated in the matrix R for placing an object in arrays XD and YD. Note how again we use matrices to reduce a general problem to a simpler one which has already been solved. The value of structured reasoning! Also note that if we only use matrices to move the observation line — ie, (EX,EY,EZ) to (DX,DY,DZ) — then we will find that the scene will take on a peculiar orientation. To counteract this problem we maintain the vertical so that lines that are vertical in the scene — ie, parallel to the y-axis — remain vertical in the projected picture. Also note that we also require another routine — angle — which calculates the angle that a line from the origin to a point (AX,AY) of 2.D space makes with the positive x-axis.

Now Run the first program with the new look3, typing in (EX,EY,EZ) and (DX,DY,DZ) from the keyboard on request. Now you will see that the first cube need no longer look like a square.

You can change the names of the two object procedures to cube and icosahedron and write a new scene3 procedure to call them individually and create a new scene which contains one cube and one icosahedron.

Listing 4 gives a procedure genrot which again introduces a matrix to update matrix R. Note this too uses function angle, again demonstrating the value of structured programming. Genrot has the effect of rotating space by an angle Gamma about a line — an axis of rotation — which passes through the point (PX,PY,PZ) and which is parallel to the line from the origin to (QX,QY,QZ). The problem reduces to the construction and product of seven matrices.

$$F-1 \times G-1 \times H-1 \times W+H+G \times F$$

F translates space so that the line now passes through the origin. G moves the axis of rotation into the x-z plane through the origin, H rotates space so that the axis is now identical to the z-axis. We represents the rotation by an angle GAMMA about the z-axis — now the axis of rotation — and the remaining matrices F-1, G-1 and H-1 reverse the effect of F, G and H. There is no need to calculate the inverse of F, G and H explicitly, they can be evaluated directly. Note that F created by tran3 with TX, TY and TZ is inverted by tran3 with -TX, -TY and -TZ. G and H, created by 'rot3' given Theta and the axis, are inverted by calls to rot 3 with -Theta and the same axis.

Listing 4 also contains a scene3 procedure which is an expanded version of that given in listing 1, and must be used to replace lines 6000 to 6130 of that listing.

Try the program with MODE = 4, HORIZ = 2, (PX,PY,PZ) = (0,1,0) (QZ,QY,QZ) = (1,1,1), Gamma = 1. Use (EX,EY,EZ) = (0,0,0,) and (DX,DY,DZ) = (0,0,1), ie, the original Observed position.

Having considered how to use matrices to move vertices about space in a systematic way, and also how to create scenes relative to a moveable observer we now concentrate on constructing more complex scenes. You will have realised by now that the most tedious part of creating a picture is the construction of data. There are many techniques for saving time and effort. One of the simpler methods is to make use of any symmetry in the object.

Take the construction of a wire jet, you will notice that the figure is symmetrical about the plane down the centre of the object, that is for every vertex (x,y,z) with positive x, there is an equivalent vertex (-x,y,z). We can use this symmetry to give the machine just half of the data, and let it construct the other half. This method is given in procedure jet in listing 5, together with a new scene3 procedure.

When creating objects like this you first make a rough plan of the construction on graph-paper, and then transfer it to data statements.

Try Running the program in Mode 4 with HORIZ=200, (PX,PY,PZ)=(1,2,3), (QX,QY,QZ)=(1,1,1), GAMMA=1, with (EX,EY,EX)=(1,2,3) and (DX,DY,DZ)=(0,0,0). You are now in a position to construct spaceships, cars and houses using this same method.

Listing 6.

```
6000REM" scene3 / consisting of
   2 similar objects
6010DEF PROCscene3
6020DIM X(66),Y(66),Z(66),XD(66),YD(66)
6030DIM LIN(2,99),A(4,4),B(4,4),R(4,4)
6040NOV=0 : NOL=0
6049REM" place IAN in SETUPposition
6050PROCi : PROCa : PROCn
6059REM" specify general rotation
6060PROCidR3 : CLS
6070INPUT"(PX,PY,PZ)",PX,PY,PZ
6080INPUT"(QX,QY,QZ)",QX,QY,QZ
6090INPUT"GAMMA",GAMMA
6100PROCgenrot(PX,PY,PZ,QX,QY,QZ,GAMMA)
6109REM" OBSERVED position
6110PROClook3
6119REM" draw the scene
6120PROCdrawit
6129REM" draw another picture
6130GOTO 6060
6140ENDPROC
6500REM" letter I
6510DEF PROCi
6519REM" data for front-face of I
6520DATA 1,2, 2,3, 3,4, 4,5, 5,6, 6,7, 7,8, 8,9, 9,10
, 10,11, 11,12, 12,1
6530DATA -96,60, -96,30, -135,30, -135,-30, -96,-30,
-96,-60, -204,-60, -204,-30, -165,-30, -165,30, -204,3
0, -204,60
6540RESTORE 6520
6550NUMV=12 : PROCfillit
6560ENDPROC
6600REM" letter A
6610DEF PROCa
6619REM" data for front-face of A
6620DATA 1,2, 2,3, 3,4, 4,5, 5,6, 6,7, 7,8, 8,1, 9,10
, 10,11, 11,9
6630DATA 15,60, 60,-60, 30,-60, 22,-40, -22,-40, -30,
-60, -60,-60, -15,60, 0,20, 15,-20, -15,-20
6640RESTORE 6620
6650NUMV=11 : PROCfillit
6660ENDPROC
6700REM" letter N
6710DEF PROCn
6719REM" data for front-face of N
6720DATA 1,2, 2,3, 3,4, 4,5, 5,6, 6,7, 7,8, 8,9, 9,10
, 10,1
6730DATA 90,60, 120,60, 180,-18, 180,60, 210,60, 210,
-60, 180,-60, 120,18, 120,-60, 90,-60
6740RESTORE 6720
6750NUMV=10 : PROCfillit
6760ENDPROC
6800REM" fillit
6810DEF PROCfillit
6820FOR I%=1 TO NUMV
6828REM" create 3*NUMV lines
6829REM" READ 2-D line-DATA for letter
6830READ L1,L2
6839REM" place front-face lines
6840J%=NOL+I% : LIN(1,J%)=L1+NOV : LIN(2,J%)=L2+NOV
6849REM" place back-face lines
6850J%=J%+NUMV : LIN(1,J%)=L1+NOV+NUMV : LIN(2,J%)=L2
+NOV+NUMV
6859REM" place lines joining faces
6860J%=J%+NUMV : LIN(1,J%)=I%+NOV : LIN(2,J%)=I%+NOV+
NUMV
6870NEXT I%
6880NOL=NOL+3*NUMV
6889REM" create 2*NUMV vertices
6890FOR I%=1 TO NUMV
6899REM" READ front-face vertices
6900READ XV,YV
6909REM" place front-face vertices
6910J%=NOV+I% : X(J%)=XV : Y(J%)=YV : Z(J%)=0
6919REM" place back-face vertices
6920J%=J%+NUMV : X(J%)=XV : Y(J%)=YV : Z(J%)=10
6930NEXT I%
6940NOV=NOV+2*NUMV
6950ENDPROC
```

■

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HEARTSTOP

BBC

This month John Dawson explains how to reach a diagnosis and what to do about it.

THE PREVIOUS instalments of Heartstop have been concerned with the parts of the game that present information to the player and take in his or her responses. That work is not finished but the rest appears to be a matter of writing the code rather than developing new ideas.

This month I have written about the central part of the game, the section where the player has to identify the cause of the patient's illness and decide what to do about it. This process is an enormously simplified model of the work undertaken by junior hospital doctors. Heartstop must be organised to present the patient's symptoms and allow a player to work towards a correct diagnosis, which, incidentally, will be allocated almost randomly like the names of the patients. It would be satisfying to weight the diagnosis towards certain classes of disease according to the age or sex of the patient but that is a minor refinement.

In real life computers are used to assist doctors in making a diagnosis, not to play the patient's part. Many doctors still believe that there is no place for computers in making medical judgments so let us look at the idea first before going on to see how the computer's role can be reversed.

When a patient that the doctor has not seen before comes into the consulting room, the range of things that could be wrong is very large indeed. The patient may be suffering from one or more of several thousand diseases. In addition to the things that are troubling the patient, he or she may have any number of aspects of their body or personality that are close to the limits of the normal range.

Each patient is a unique individual although a "family resemblance" or shared genetic characteristics make it easier to strike up a relationship by providing indicators as to the response we are likely to get. The negative side of prejudging a person on the basis of a family resemblance is that we tend to ignore the unique characteristics of the person in favour of the easier stereotype.

However, at the moment when a new patient walks in the doctor's antennae — his cognitive span — must be extended as far as possible to pick up both the gross signs of disease and to appreciate how the patient's problems relate to the whole of his personality and environment. This process will be familiar to any reader of Sherlock Holmes, said to have been modelled on one of Conan Doyle's medical teachers.

Watson: "But what were his relations with the governess and how did you discover them?"

Holmes: "When I considered the passionate, unconventional, unbusinesslike tone of his letter, and contrasted it with his self-contained manner and appearance, it was pretty clear that there

(continued on page 158)

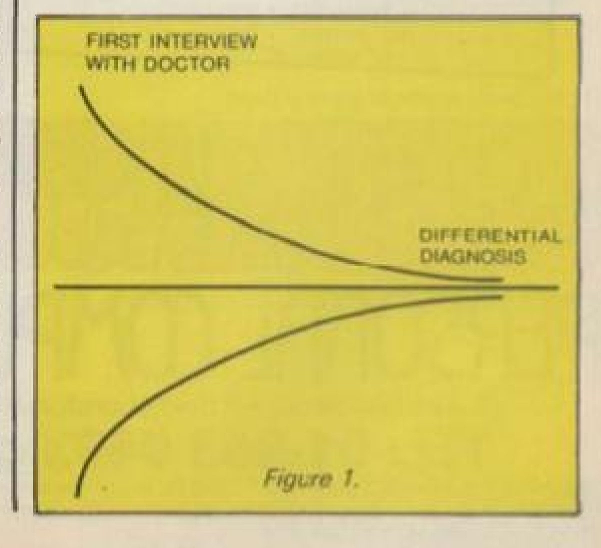


Figure 1.

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(continued from page 155)
was some deep emotion which centred upon the accused woman rather than the victim. We've got to understand the exact relations of those three people if we are to reach the truth."

The Client: "You're like a surgeon who wants every symptom before he can give his diagnosis."

That is taken from *Thor Bridge* in *The Case Book of Sherlock Holmes*. The next extract from *The Creeping Man* makes the point that a good doctor watches for small events or signs that will help him to understand the whole patient, not just the gross symptoms of an illness:

Holmes: "A dog reflects the family life. Whoever saw a frisky dog in a gloomy family, or a sad dog in a happy one?"

Watson: "Surely, Homes, this is a little far-fetched?"

Holmes: "One possible loose end lies in the question: why does Professor Presbury's faithful wolf-hound Roy, attempt to bite him?"

Watson: "I sank back in my chair in some disappointment. Was it for so trivial a question as this that I had been summoned from my work?"

Holmes glanced across at me. "The same old Watson!" said he. "You never learn that the gravest issue may depend upon the smallest things."

As the doctor listens to the patient's history, bits of the pattern will begin to fall into place and the nature of the problem starts to emerge from the thousands of possibilities. A physical examination, backed up, perhaps, by some laboratory tests narrow the possibilities still further, to the point where the doctor can write out a short list of causes for the patient's condition — a differential diagnosis — or make a firm diagnosis.

Dr Marsden S. Blois from the University of California, writing in the *New England Journal of Medicine* in 1980, represents the process I have outlined above as a horn or funnel — figure 1. The large, open end of the horn represents the doctor's cognitive span at the time he first sees the patient. The closed end of the horn, the point at which the doctor has a differential diagnosis, is also the point at which he believes computers have most to offer in clinical management.

Expert systems, which are equivalent to the Intelligent Knowledge Based Systems — IKBS — discussed in the *Alvey Report*, work by using a set of rules to construct a "micro-world". Within the computer's micro-world the machine is able to predict with a fair degree of certainty what is causing a certain condition, what is the chance of finding oil under a particular piece of countryside, or what is the cause of your car's failure to start one morning. What the machines cannot do at present is to relate the illness to the patient's environment, assess the aesthetic damage that will be caused by drilling for oil, or decide what should be the balance between motor cars and pedestrians in a town shopping area.



Medial expert systems have been built for a number of purposes. Suppose you were programming a computer to deal with a person who had a pain in their arm. There are some simple questions you would need to have answered about the nature of the pain:

When did the pain start? Did it come on suddenly or slowly? Is it constant, or is it getting better or worse? Does movement make the pain worse? Does the pain spread to anywhere else? Can the patient feel normally with his fingers? Are the muscles in the arm as powerful as usual?

These questions presuppose that the pain is inside the arm and that there is nothing visibly wrong with the arm. So you might like to add some more questions:

Does the paitent know what made the pain start? Does he have any other illnesses at present? Has he fallen over on to the arm? What was he doing at the time that the pain started?

Already you have quite a lot of information about a very small part of the patient's body, and I have deliberately reduced the questions that would link a pain in someone's arm to a condition somewhere else. Some simple rules can be applied immediately to the results of these questions.

■ If the patient fell over, or was involved in a road traffic accident; and if the pain is worse when the arm is moved; and if it is not getting better; and if there is less power in the muscles than usual; then there is a reasonable possibility that the patient has broken a bone.

■ If the patient is a middle aged male; and if the pain started in the centre of his chest; and if the pain spread down his arm; and if there is a previous history of heart disease; then there is a possibility that the patient has angina, or has had a heart attack.

■ If the patient was involved in a road traffic accident at some time in the past; and if there is some loss of feeling in parts of the arm; and if there is some loss of power in the muscles; then the patient may have damaged part of his neck where the peripheral nerves serving his arm leave the spinal cord.

All three of these networks of rules use multiple and operators to link one rule with another. None of them lead to a definite answer and all of them would be intensely unsatisfactory for a patient to use. The second example is entirely unconcerned with the patient's occupation and the amount of stress that he may feel at work or at home. Nevertheless, within a micro-world an expert rule based system can provide answers that are at least as good as any single doctor.

Dr Marsden says in his article that there is no threat to the doctor's work because it is impossible to create enough micro-worlds to mimic the judgments made by the doctor at the open end of the funnel. I am not so sure. At the least, it seems that the development of more sophisticated expert systems will tend to move more and more medical care out of



hospitals and into the general practitioner's surgery.

After all it is the GP who deals with the thousands of possibilities at the open end of the horn; by the time a patient sees a junior doctor or consultant in hospital, the GP should have excluded all but a few possibilities. The GP may have arrived at a definite diagnosis and then refer the patient to hospital for treatment that cannot be provided in the community.

How does all this relate to Heartstop? Well, the program needs an orderly way of releasing information about the patient's condition to the player. In other words the program must respond to the "doctor's" questions, giving information that is consistent with the diagnosis that has been assigned to the patient. If the "doctor", the player, draws the correct conclusion from the information presented by the program, Heartsop should allow him or her to advance closer to the right answer until a definite diagnosis is made.

The first, obvious problem here is that most people are not doctors and will not know what questions to ask their BBC computers. Secondly, computers do not like variations on a theme and there must be several hundred ways of asking "Where's the pain?." Multiple choice questions seem to be the answer to both of these problems. The selection of questions offered to the player at any one time should depend on previous questions that have been selected.

An interrogation process of the type I have outlined will need a fixed starting point and a firm perimeter fence to limit the branches down which a player can travel. The first set of questions might include these:

Do you have any pain? Can you breathe all right? Are you taking any medicines? Is your weight doing up or down?

The firm perimeter may be a bleep message requiring the player's attention in a different part of the hospital, which will end that examination of the patient. Clearly, also, the "doctor" must be able to resume the patient's examination and that will require the program to store the current status of the patient's differential diagnosis. Heartstop might well give a new paitent not only the final diagnosis but also a set of more or less probable alternatives; these could be stored as integer numbers in an array and erased as the player discards them in the course of his examination.

All this sounds pretty difficult to achieve and the quantities of text involved may not fit easily into a cassette-based BBC computer. ■

PARALLEL PRINTER INTERFACE

Chris Thorpe with a routine to enable your Vic-20 to accept Centronics interface printers.

HAVING OWNED A Vic-20 for about a year I decided that a printer would be a most useful addition. I looked at what was available. Because the Vic is designed to control a printer using its IEEE port as opposed to the much more universal Centronics interface, there is only a very limited choice available. As these did not fit my requirements I wrote this program which should enable the Vic-20 to drive most Centronics interface printers.

The printer is driven using one of the VIAs — Versatile Interface Adaptors — available to the user on the rear of the machine. VIA 2 is used mainly for scanning the keyboard and so is best left well alone. VIA 1 port B is free for use and port A is only used for joystick and lighpen control. The three joystick ports on VIA 1 port A are used for handshaking signals, as is CB1 on port B. All eight I/O lines on port B are used for the data transfer.

A full Centronics interface is implemented using the Busy, Acknowledge, Strobe and eight data lines. An additional line, Select, is provided and can be used for detecting a print on/off or power down of the printer. This would prevent the program from getting locked in a loop, waiting for the printer to be ready for use. It need only be connected if required. If not used care should be taken not to Sys to the printer routine when the printer is switched off.

Printout will be of the same format as displayed on the screen, ie., uppper and lower case, and is program-selectable in the same way. Since the same graphic character set used on the Vic-20 will not be available on the printer it is recommended that CHR$ statements are used instead of their graphic representations. This, of course, only applies for the purpose of listing. Any colour change or inversion will be ignored by the printer but will still be sent to the screen.

To do this the interface program must be capable of checking characters to be sent to the printer and altering them if necessary while still preserving the criginal value for use by the screen. This is achieved by using two lists, one with the original character values and

(continued on page 163)

```
10 DEF FNA(X)=(PEEK(55)+256*PEEK(56))+X
20 DEF FNB(X)=INT(FNA(X)/256)
30 DEF FNC(X)=FNA(X)-(256*FNB(X))
40 X=-245:POKE55,FNC(X):POKE56,FNB(X)
50 POKE51,FNC(X):POKE52,FNB(X):POKE643,FNC(X):POKE644,FNB(X):X=0:A=FNA(X)
60 Z=0:FORB=0TO244:READC:Z=Z+C:NEXT:RESTORE:IFZ()23924THENPRINT"DATA ERROR":STOP
70 FORB=ATOA+244:READC:POKEB,C:NEXT
80 POKEA+29,FNC(39):POKEA+34,FNB(39)
90 POKEA+61,FNC(199):POKEA+62,FNB(199)
100 POKEA+131,FNC(73):POKEA+132,FNB(73)
110 POKEA+118,FNC(132):POKEA+119,FNB(132)
120 POKEA+128,FNC(165):POKEA+129,FNB(165)
130 POKEA+218,FNC(63):POKEA+219,FNB(63)
140 POKEA+224,FNC(73):POKEA+225,FNB(73)
150 PRINTCHR$(18)" CENTRONICS INTERFACE "CHR$(146)
160 PRINT"SYS"A"TO ENABLE":PRINT"SYS"A+231"TO DISABLE"
170 NEW
180 DATA169,255,141,18,145,169,132,141,19,145,169,238,141,28,145,169,0,141,29,14
5,141
190 DATA16,145,169,130,141,30,145,169,0,141,38,3,169,0,141,39,3,96,201,10,240,69
,134
200 DATA112,72,173,31,145,41,8,240,56,173,5,144,41,2,240,3,76,0,0,104,72,201,32,
48,46
210 DATA201,90,16,42,72,173,31,145,41,16,208,249,104,141,16,145,173,31,145,73,4,
141,31
220 DATA145,234,234,234,234,9,4,141,31,145,173,29,145,41,16,240,249,104,166,112,
76,122
230 DATA242,162,33,221,0,0,240,5,202,240,5,208,246,189,0,0,76,0,0
240 DATA142,5,18,28,30,31,144,146,156,158,159,17,19,29,91,93,94,95
250 DATA133,134,135,136,137,138,139,140,145,147,157,1,2,3,13
260 DATA0,0,0,0,0,0,0,0,0,0,0,0,32,123,125,91,93
270 DATA129,132,142,139,130,136,141,135,0,0,0,29,30,31,13
280 DATA104,72,201,65,144,12,201,91,144,11,201,193,144,4,201,219,144,9,76,0,0,24
,105
290 DATA32,76,0,0,56,233,128,208,248,169,122,141,38,3,169,242,141,39,3,32,249,25
3,96
```

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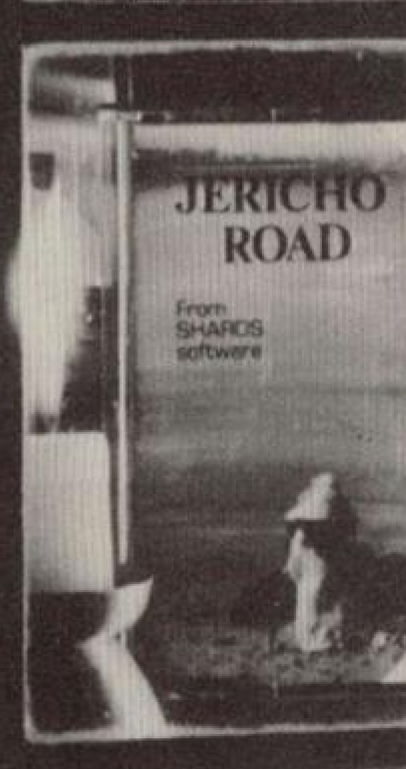
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(continued from page 161)
another with the replacement values. The character is compared with the values in the first list and, if found, is substituted — for use by the printer — with the value in the equivalent position in the second list.

These characters have been made easily available in lines 230 to 270 of the Basic program. Lines 230 tand 240 contain the Vic-20 character values and lines 250 and 260 contain the new values. This process is also necessary to correct the Vic character set which is not a standard ASCII version. The character-per-line selection now becomes CHR$ (3) for 132 cpl., CHR$ (2) for 80 cpl., and CHR$ (1) for 40 cpl.

The machine-code program requires only 245 bytes. The Basic program calculates this amount down from the top of memory and Pokes each value in via Data statements. The program is therefore usable with any Vic-20 with any amount of memory. The top of memory pointers are also set 245 bytes down to protect the machine code from being overwritten by a Basic program. When finished the program News itself. The screen will then display the Sys locations to enable and disable the printer. Once enabled anything sent to the screen will also be sent to the printer until Sys to disable or Run/Stop and Restore are pressed. The printer can then be re-enabled at any time with a Sys to enable.

Pins 1,2,3,7,8,9,10,11,12,m,n on the user port are not used in this interface. All the other pins are connected as shown in figure 1 — for example, Vic pin 4 to printer pin 1. The function of each pin is also shown. For the user port a 12-12 way 0.156 inch pitch edge connector is required. This size is not easily available so a 15-15 way connector was cut down to size using polarising pins to prevent improper connection.

The printer requires a 36 pin amphenol connector and the two connectors are most conveniently linked using 13 ways of a 16 way length of ribbon cable. All these parts are easily available from electronics shops and by

(continued on page 165)

Basic program notes

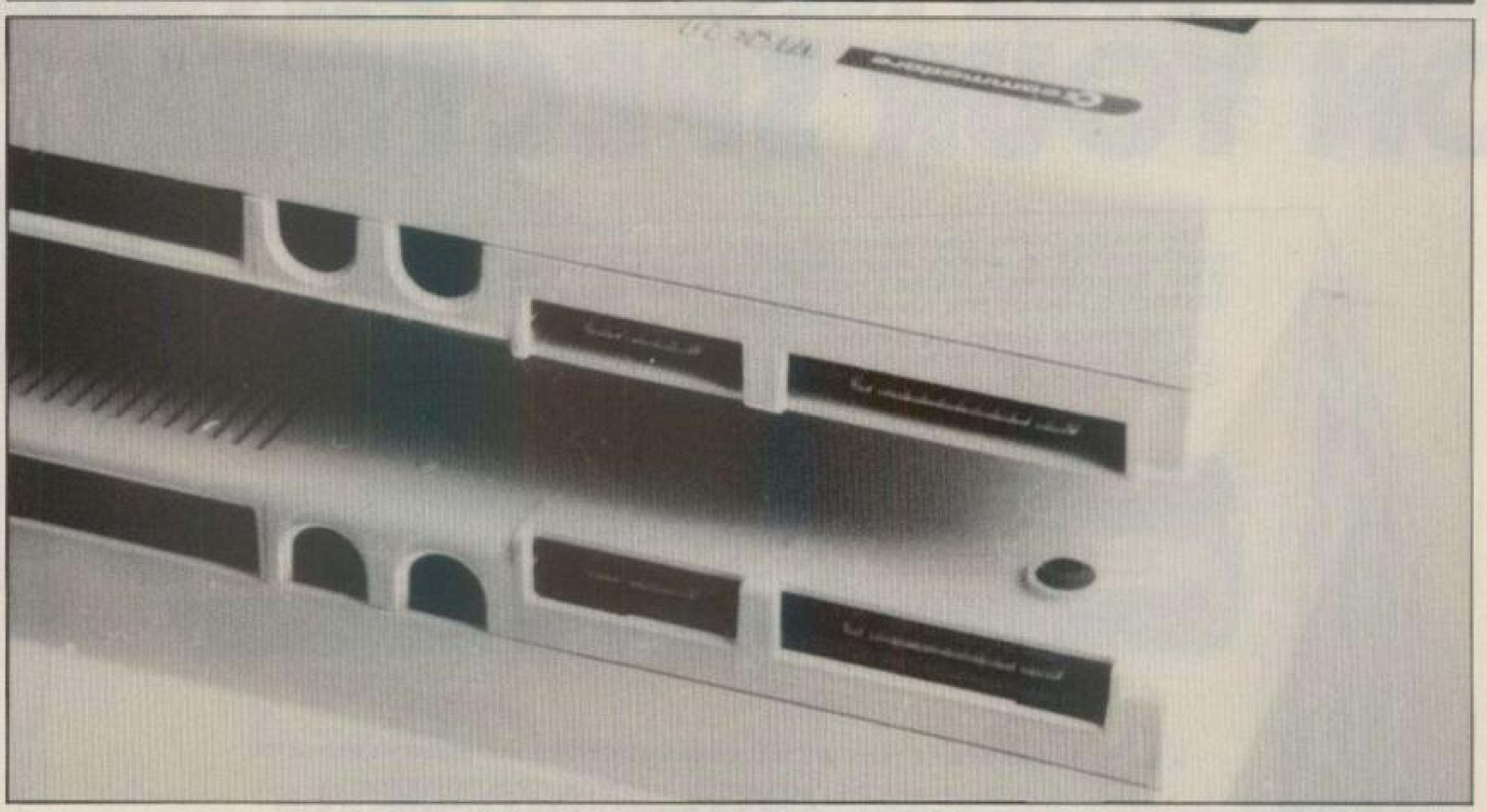
Line 10 defines FNA(X) to calculate a decimal address from a two byte address.
Line 20 defines FNB(X) to calculate the high byte of a decimal address.
Line 30 defines FNC(X) to calculate the low byte of a decimal address.
Line 40 lowers the top of memory to protect the machine code.
Line 50 lowers top of string storage etc.
Line 60 checks all data in line 180 upwards has been entered correctly. If the CHR$ lists are altered or removed.
Line 70 Pokes the machine code into memory.
Lines 80 to 140 Poke values of actual jump addresses into memory.
Lines 150 to 160 Tell you where to Sys to start and stop the printer.
Lines 180 to 290 are the machine code data.

Figure 1. Connection details

VIC USER PORT		PRINTER		
Pin no.	Function	Pin no.	Function	Description
4	PA2	1	Strobe	Data is read by the printer when this line goes low.
5	PA3	13	Select	A low signal indicates printer disabled.
6	PA4	11	Busy	High signal indicates printer not ready to accept data.
A	Ground	19	GND	Common earth line.
B	CB1	10	Acknow.	A low pulse indicates data received.
C	PB0	2	Data 0	
D	PB1	3	Data 1	
E	PB2	4	Data 2	
F	PB3	5	Data 3	Carry the ASCII code of the character to be printed
H	PB4	6	Data 4	
J	PB5	7	Data 5	
K	PB6	8	Data 6	
L	PB7	9	Data 7	



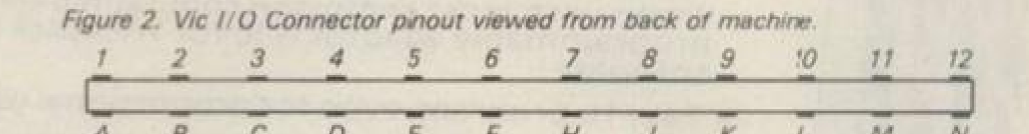
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(continued from page 163)
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I have successfully used this program with an OKI microline 80 printer for many months now although it may be wise to test the program with a particular printer before purchase.

Figure 2. Vic I/O Connector pinout viewed from back of machine.



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The SP80 simply plugs into the sockets in the 16k Spectrum. Full fitting instructions are provided. It is easy to fit and no soldering is required.

See 48/80 FORTH for another angle.

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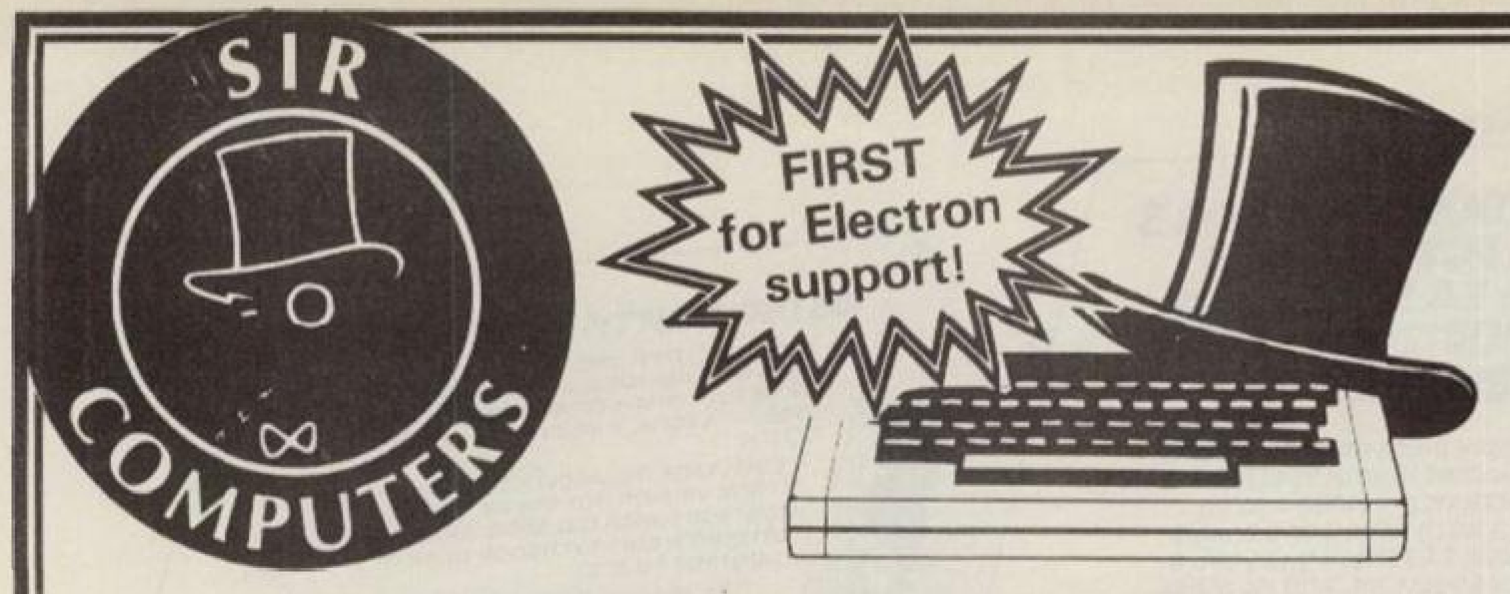
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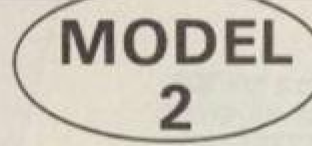
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PEEK AT LYNX

■I have recently bought a Lynx computer, and am entirely satisfied with it, except for one point.

The manual gives no starting and finishing addresses for Poking into the screen. I also do not know what the Peek locations are. If the computer does not check by Peek, how do you check for such things as a car hitting a wall?

P Greenwood,
Southport,
Birkdale.

PEEKING AND Poking on the Lynx are not simple.

There are two reasons for this. First, the screen is high resolution. Therefore, to read the character in a specific location, you have to read 96 bytes. This is because characters are six pixels wide, so characters are often mapped onto more than one byte.

In addition, the high-resolution memory map is complicated by the fact that the memory is banked. Therefore, only a quarter of screen memory is available to Basic at any one time.

I suggest you use the Point function to get the colour of a single pixel. This will be considerably faster than using Peek.

UPGRADING

■I am the owner of an issue two 16K Spectrum which I would like to upgrade to 48K. I have read that to do this requires only eight chips, which plug into places already allocated inside the micro case. Is it possible to find out what these chips are, and where they go?

P Blacklock,
Didsbury,
Manchester.

THE CHIPS NEEDED are 32K RAM chips. The best idea is to buy a Spectrum upgrade kit which provides the chips, and instructions on how you can fit them yourself. This will cost less than twenty pounds. The chips are not generally available, so buying a kit is the best idea.

PROGRAM FAULT?

■During recent conversation with friends, I was discussing the power of doubling up numbers, particularly if one applies this effect on a chess-board. A few days later, I tried to write a program on my ZX-81 to print out the doubling up effect on a simulated chess board.

After some time I came up with the following program:

```
10 LET N = 1
20 FOR C = 1 TO 64
30 SCROLL
40 IF C<10 THEN PRINT "SQU NO
   ";C;" = ";N
50 IF C>=10 THEN PRINT "SQU NO
   ";C;" = ";N
60 LET N = N + N
70 NEXT C
```

Lines 40 and 50 are only to clarify and tidy the display, and of course could have been written as PRINT C;N or simply as PRINT N.

The above program works . . . up to a point. Up to square 27, the 'doubling up' is correct, and at this square it reads 67108864. Therefore, the next square — number 28 — should read 134217728. However, my ZX-81 insists it is 134217730 which of course renders the rest of the program useless.

I have even cleared the computer and entered as a direct command PRINT 67108864 + 67108864 and it still insists that the answer is 134217730. Could you advise me as to what is wrong with my program?

P Sutton,
Brighton.

THERE IS NOTHING wrong with your program. The fault lies within the computer. Like many computers — and your pocket calculator, as you will see if you try it — the ZX-81 works to a limited number of significant figures and rounds answers which demand greater precision. The simplest way around this is to work with strings, and manipulate numbers within the strings.

ZX-81 REM

■I need to enter a Rem statement of 2303 characters for a ZX-81 machine code program. This is around 70 lines. How can I enter this? Just typing in the lines would take hours, even in Fast.

M Payne,
Coventry.

PROBLEMS ARE caused by the fact that the ZX-81 display gets very agitated — translation: does not know how to handle — a line which is greater than the size of the screen. You could create a suitable line by setting up a small string, then concatenating this string to itself within a loop, checking with LEN to stop the looping when the line was long enough. The Let A$ could be changed to Rem with a few Pokes. However, it would not be possible to List the line in this form. *Machine Language made Simple* (published by Melbourne House) and/or *Mastering machine code on your ZX-81* (Interface) should help you develop your ZX-81 machine code skills further.

SPEEDY SAVING

■Is there any way in which the Loading and Saving can be speeded up on the ZX-81. I know there are commercial hardware and software packages available, but would like to know if a machine-code routine to do this has ever been published.

R J Clark,
Walthamstow,
London E17.

THE TWO systems I have seen in action — sold commerically as Quickload and Fastload — are in software form, and work extremely well. One of them even has built-in error checking, and allows you to actually stop the Stop during a load, wind it back a bit, and then continue the Load! The screen display also indicates whether or not the load is proceeding satisfactorily. The systems are distributed by Mindware (USA) and Gladstone (Canada). I am not aware of any suitable routines which have been published.

CBM 64 SAVE

■I own a Commodore 64. At the moment, I am using the Commodore cassette player, and want to be able to Save data files direct to cassette. I cannot find any articles telling me how to do this.

Matthew Ettlin,
Church Lawton,
Stoke-on-Trent.

YOU NEED TO open a file, and you do this on the Datassette with a line like

```
OPEN 1,1,2,"NAME OF FILE"
```

The information you need can then be entered, via an Input — such as INPUT Z$ — line in a program, directly from the keyboard. If you included

```
PRINT #1, Z$
```

as the next line of the program, the information you had just entered will be Saved on tape. You can go back to your input line as many times as necessary, then exit from this loop and include a CLOSE 1 line to close the file.

To get the information back, you need the line

```
OPEN 1,1,0,"NAME OF FILE"
```

with

```
INPUT #1, Z$
```

to read the item back, and PRINT Z$ to see it on the screen. If you use GET#1, Z$ the computer will read back the data one byte at a time.

TWO KEY READ

■On the ZX-81 there are two ways of reading input from the keyboard, ie. Inkey$ and a Peek into the system variables. Inkey$ reads only one character at a time, and the Peek's result can be interpreted as two characters, eg., "G" and "A". On the Vic-20, there are Get A$ and Peek(197) but these only read one character at a time. Is there a method of reading two keys at once on the Vic?

David Spencer,
Chapel-en-le-Frith
Cheshire.

THE EASIEST WAY to do this is include a line like

```
Z$ = ""
```

before your Get A$, and then set Z$ equal to the Z$ plus the result of Get A$. Then, if Z$ was less than two characters long — checked with LEN — the program could go back to the Get A$ line, and add the result of that second reading to the value already given to Z$. This routine could be, of course, used for any length input, not just two letters.

INPUT ITEMS

■I own a 48K Spectrum and would like to be able to enter input items at different screen locations, to match up with the questions being asked. I find it rather annoying to program questions at different screen positions, only to find that the input always appears at the bottom of the screen. Can you help please?

T Baker,
Fareham,
Hants.

THE POSITION THE input prompt appears — at the bottom of the screen — cannot be modified. However, you could enter the question as a Print At, at any location of the screen you desired, and then just have the input within the program as Input A$ or Input N. Although this would not move the actual input onto the screen, at least the questions would appear where you want them.

SAVING SPACE

■I am having trouble fitting a program I have written for the BBC micro into the available memory. How can I reduce it?

N Richards,
Stroud,
Gloucestershire.

IT IS EASY enough to run out of RAM on the BBC. I presume your program uses the high-res modes leaving you a mere 8K to play with. Nonetheless you should be able to save at least several hundred bytes if you take the following measures:

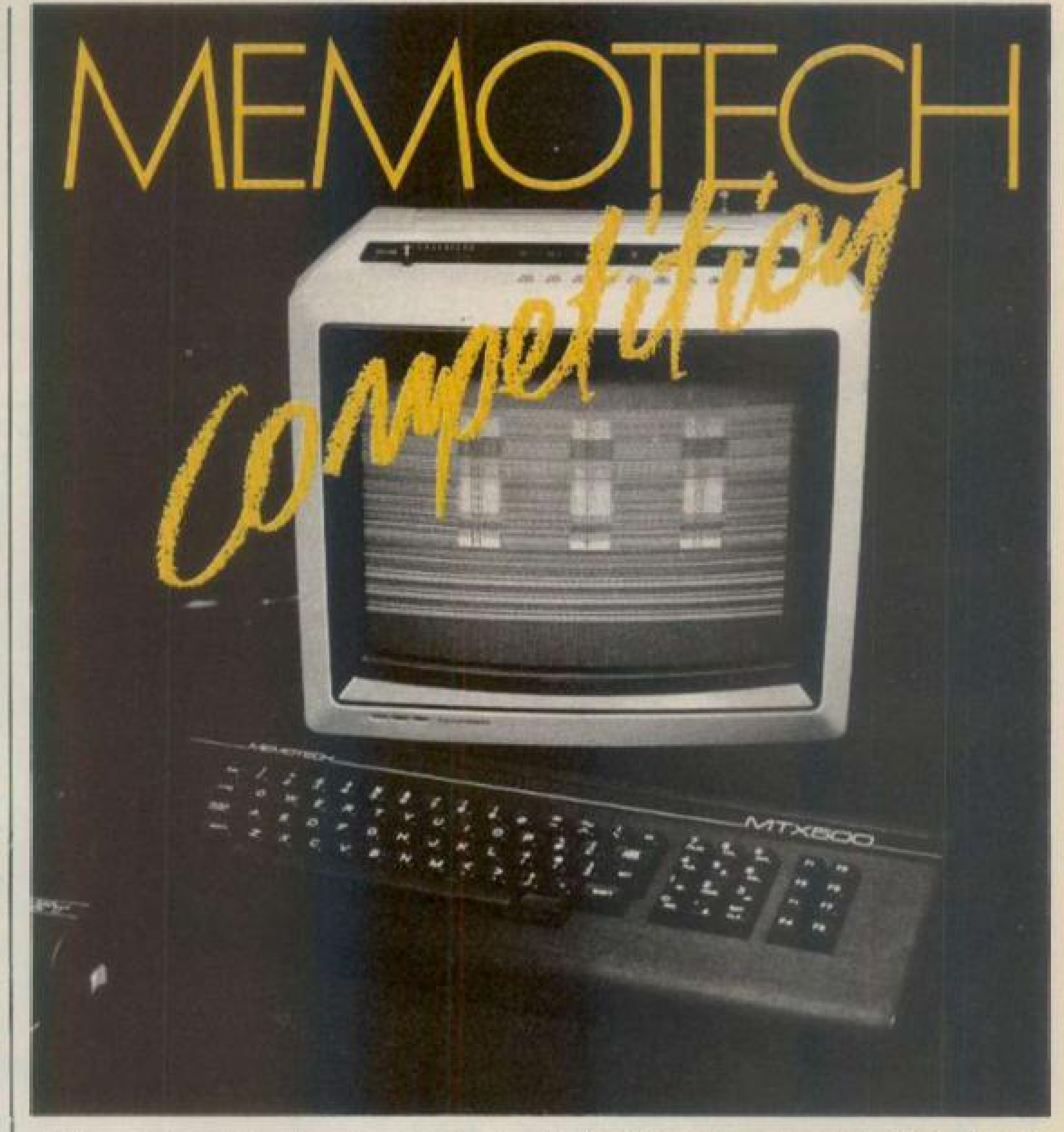
■Take out as many spaces as possible including those at the end of lines. Redefining the space character can help you spot them. Enter VDU 23,32,255,255,255,255,255,255,255, 255 and then change to a non-teletext mode.

■Multi-statement lines. Cram as many statements as possible onto the same line. Be careful, however, with If Then statements.

■Shorter variable names and use the single letter integer variables, A%, B% and so on. Basic reserves space for those below &E00 so they will not encroach on your program area.

RULES

- The winner of the competition will be the person who enters a correct solution to the crossword and, in the view of the editor, completes the unfinished sentence in the most interesting way.
- The name of the winner will be printed in the April issue of *Your Computer*.
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MEMOTECH'S BUSINESSLIKE new micro made a real impression when we reviewed it last November. Now you can win one for yourself with our "Win a Memotech" competition. This is what we said about the Memotech MTX 500 — this month's prize:"

"When everyone else seems to be fighting to produce the cheapest computer with both colour and sound Memotech has taken a very different approach. Leaving its ZX-81 beginnings far behind it has produced a computer that would not disgrace any executive's desk. The cost is £275.

The styling of the MTX-500 is striking. In fact it looks more like a 16 bit business computer than a home micro. It has a real keyboard housed in a slim and solid black anodised aluminium cabinet. This is longer — 1'7" — then virtually any other home micro-computer since it also houses a 12-key numeric keypad and eight separate function keys to the right of the main keyboard.

The quality of the keys lives up to the general appearance. They have a professional and solid feel and a touch typist would feel at home with them. Word-processing would be a joy.

Memotech has stayed on familiar ground with the central processing unit. This is a Z-80A — running a 4MGz — as used by Sinclair in its ZX computers.

Living up to its name, Memotech, memory is not something one is likely to be short of. The MTX-500 comes with 32K of RAM memory — the MTX-512 has 64K RAM — available for programs. An additional 16K RAM is dedicated to the video processor and thus the 32K RAM is nearly all available to the user even in high resolution." All you have to do to win the Memotech is solve the puzzle and then think of the most appropriate ending for the sentence: "At work and at play a Memotech would make my day . . .", 12 words or fewer. ■

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You have to break out these six black bricks from the wall by giving each a push in a direction at 45° from the vertical: either ↗, ↘, ↖, or ↙. As it meets a brick in its way it instantly destroys that brick and bounces off exactly in the direction it would in real life. If it should hit two bricks simultaneously then both are destroyed — if it should hit another black brick then both black bricks are destroyed. In which order should you push each black brick and in which direction to get out as many black bricks as possible — while destroying as few other bricks as possible?

First ______ ☐
Second ______ ☐
Third ______ ☐
Fourth ______ ☐
Fifth ______ ☐
Sixth ______ ☐

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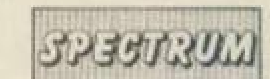
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Speech synthesis

Ian Morgan,
Woodley,
Berkshire.



THE MAIN PROGRAM is written in Basic and contains really only three important subroutines. These are: Listen; Speak; Edit.

Before the Listen routine is called another machine-code routine, Clear, is called. This routine zeros a required amount of memory for the use of the listen routine.

The Basic subroutine — 3000 to 3100 — calls a machine-code routine which listens to both the Ear and Mic ports. Unlike the Talk to your Spectrum article in November 1982, my routine counts the number of times a noise is heard and then the number of times silence is heard. The period of on/off is directly related to the frequency of the incoming sound. This routine is then repeated until the register pair DE becomes zero. Once this has occurred a return to Basic is made.

The Basic subroutine — 2000 to 2080 — calls another machine-code routine which actually produces the speech/sound. What actually happens is that the program takes the values stored and turns the Spectrum's speaker on or off for the required periods.

The routine is again repeated until the DE register pair becomes zero and a return to Basic is made.

The Edit routine allows you to change the memory allocation for data storage and also speech speeds.

For understandable speech a speed of two or three is preferable, variations will change the speed and pitch of the speech.

When altering memory allocation, remember "Start" should never go below 33,000 — 80E8H. This is to protect the machine code. The counter register DE is also alterable so a form of simple Editing of sounds is available.

I found that when I attached a microphone to the Mic/Ear port that the Listen program heard nothing. My best results have, therefore, been achieved by recording the speech on to tape and then playing this into the Spectrum at normal levels.

Sometimes it will be necessary to rewind the tape to play the sound again as the Spectrum might not have heard it first time. This will be obvious when the Spectrum does nothing after hearing your sound.

Load the machine code using any suitable machine code loader of your choice. The base address for the machine code is 32768, and the machine code is 102 bytes in length.

After loading the machine code type in the Basic program from the listing. Also add to the listing an extra line:

9015 GOTO 100

To Save the program just type Run/Goto 9000. This will save the Basic program and machine code in two separate parts.

The program is menu-driven and all inputs should be in a numerical form. If the program is broken, Run will restart it with no effect to the current sound.

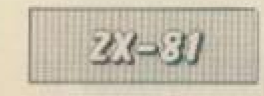
The decimal machine-code dump.

```
32768 - 33 0 250 17 0 4 243 219
32776 - 254 254 255 40 250 52 219 254
32784 - 254 255 40 12 52 24 247 219
32792 - 254 254 255 32 11 52 24 247
32800 - 35 27 122 179 32 241 251 201
32808 - 35 27 122 179 32 224 251 201
32816 - 33 0 250 17 0 2 243 78
32824 - 62 16 211 254 6 3 16 254
32832 - 13 32 249 35 78 151 211 254
32840 - 6 3 16 254 13 32 249 35
32848 - 27 122 179 32 226 251 201 33
32856 - 0 250 17 0 4 54 0 27
32864 - 122 179 200 35 24 247 0 0
```

```
  10 REM ***********************
  20 REM **                   **
  30 REM ** Speech Synthesis **
  40 REM **    I . Morgan     **
  50 REM **      1983        **
  60 REM **                   **
  70 REM ***********************
 100 GO SUB 1000: REM MENU
 110    IF C=1 THEN GO SUB 2000
 120    IF C=2 THEN GO SUB 3000
 130    IF C=3 THEN GO SUB 4000
 140 GO TO 100
1000 REM    **MENU**
1010 CLS
1020 PRINT AT 0,10;"MENU"
1030 PRINT AT 5,7;"1.....SPEAK"
1040 PRINT AT 7,7;"2....LISTEN"
1050 PRINT AT 9,7;"3......EDIT"
1060 INPUT C
1070 IF C<1 OR C>3 THEN GO TO 10
50
1080 PAUSE 50
1090 RETURN
2000 REM    **SPEAK**
2010 CLS
2020 PRINT AT 0,10;"SPEAK MODE"
2030 PRINT AT 5,3;"Press  'ENTER
' to SPEAK"
2040 LET SPEAK=32816
2050 INPUT A$
2060 RANDOMIZE USR SPEAK
2070 PAUSE 50
2080 RETURN
3000 REM    **LISTEN**
3010 CLS
3020 PRINT AT 0,7;"LISTEN MODE"
3030 PRINT AT 5,5;"Hit 'ENTER' &
 then press          'PLAY' on tap
e recorder."
3040 LET CLEAR=32855
3050 LET LISTEN=32768
3060 RANDOMIZE USR CLEAR
3070 INPUT A$
3080 RANDOMIZE USR LISTEN
3090 PAUSE 50
3100 RETURN
4000 REM    **EDIT**
4010 CLS
4020 PRINT AT 0,10;"EDIT MODE"
4030 PRINT AT 5,5;"1..MEMORY ALL
OCATION"
4040 PRINT AT 7,5;"2.......SPEEC
H SPEED"
4050 INPUT D
4060 IF D=1 THEN GO TO 4100
4070 IF D=2 THEN GO TO 4500
4080 GO TO 4000
4100 REM *MEMORY ALLOCATION*
4110 CLS
4120 PRINT AT 0,5;"MEMORY ALLOCA
TION"
4130 PRINT AT 5,0;"CURRENT STATU
S"
4140 PRINT AT 7,0;"START    >";PE
EK 32769+256*PEEK 32770
4150 PRINT AT 8,0;"COUNTER >";PE
EK 32772+256*PEEK 32773
4160 PRINT AT 10,0;"NEW STATUS"
4170 PRINT AT 12,0;"START    >";
4180 INPUT S
4200 PRINT S
4210 LET X=INT (S/256)
4220 LET Y=S-(X*256)
4230 POKE 32769,Y: POKE 32770,X
4240 POKE 32817,Y: POKE 32818,X
4250 POKE 32856,Y: POKE 32857,X
4260 PRINT AT 13,0;"COUNTER >";
4270 INPUT S
4280 LET X=INT (S/256)
4290 LET Y=S-(X*256)
4300 POKE 32772,Y: POKE 32773,X
4310 POKE 32820,Y/2: POKE 32821,
X/2
4320 POKE 32859,Y: POKE 32860,X
4330 PRINT S
4340 PAUSE 50
4350 RETURN
4500 REM  *SPEECH SPEED*
4510 CLS
4520 PRINT AT 0,7;"SPEECH SPEED"
4530 PRINT AT 5,0;"CURRENT SPEED
"
4540 PRINT AT 7,0;"SPEED >";PEEK
 32829
4550 PRINT AT 10,0;"NEW SPEED (1
-255)"
4560 PRINT AT 12,0;"SPEED >";
4570 INPUT S
4580 POKE 32829,S: POKE 32841,S
4590 PRINT S
4600 PAUSE 50
4610 RETURN
9000 SAVE "SPEECH1" LINE 9020
9010 SAVE "SPEECH2"CODE 32768,10
2
9015 RUN
9020 CLEAR 32767
9030 BORDER 0
9040 PAPER 0
9050 INK 7
9060 CLS
9070 LOAD "SPEECH2"CODE
9080 RUN
```

Space Mining

Alan Lee,
Tring,
Hertfordshire.



SPACE MINING IS A game for the expanded ZX-81. You are in a cave on an alien planet mining a precious grey mineral which makes up the roof of the cave. The rock is brought down by shooting it. Before you can get to the precious mineral you must shoot away the worthless black rock which protects it; but this has a tendency to grow downwards towards you. If it reaches the ground your base is destroyed.

You also have the problem of a UFO constantly patrolling the mine. When you shoot down a block of the precious mineral, it leaves a hole in the roof which the UFO may fire down at you. If you manage to clear a mine you are moved on to another, where the black rock grows faster and the UFO becomes more likely to fire at you.

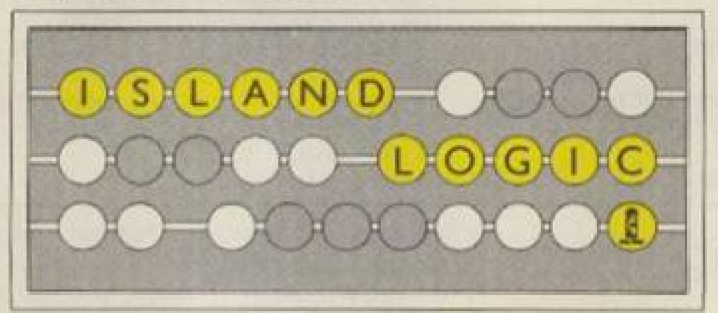
To enter Space Mining, a Rem statement of

(continued on page 178)

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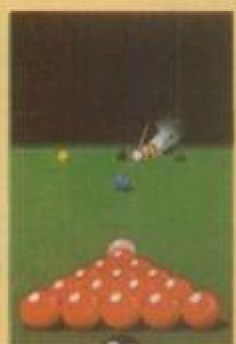


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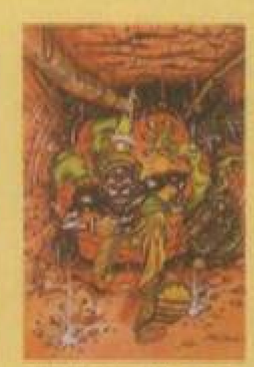
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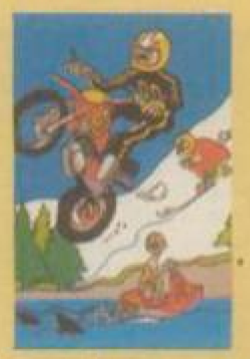
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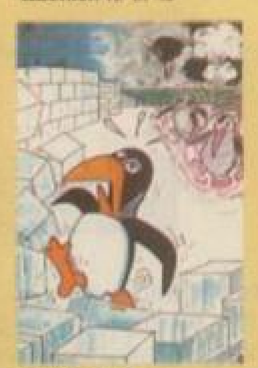
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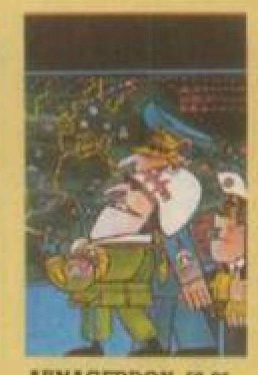
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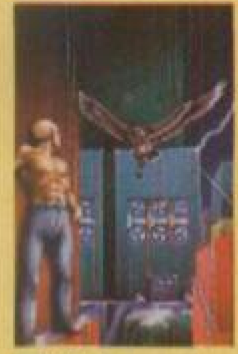
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(continued from page 175)

792 characters must be entered. This can be done in the following way:

Enter line 1 REM @@108 characters@@; edit this for lines 2-7; type in the following lines directly. Do not attempt to recall the listing by pressing Newline between each line, as this will crash the machine:

```
POKE 16511,26
POKE 16512,3
POKE 16514,118
POKE 16515,118
POKE 16510,0
```

Now type in 5 Rem Newline and Poke 16419,5. If you now press Newline, line 5 only will be displayed.

Enter program 1, the hex loader. Run the program and enter the hex codes as listed in program 2. More than one code can be entered at once, but do not put spaces between the codes.

When the last code at 17305 has been entered the hex loader will stop. Delete lines 10 to 50 then press Edit and change line 5 to LET L=USR 17035. Save the program on tape before attempting to run it. When the program is run, there should be a line of grey squares near the top, with columns of black squares extending downwards.

Your laser base nearer the bottom of the screen, should move right when 8 is pressed and move left when 5 is pressed. 0 should fire a bomb, which will travel upwards and should disappear when a black square is hit; one point is scored for this. If a grey square is hit, it will reappear on the line beneath your laser base; 10 points are scored for this. The UFO should be continuously moving from right to left along the top line of the screen, and it may release a bomb when flying over a gap in the roof.

If you are hit by one of these you lose one of your three lives. If a column of black rock hits the ground, the game ends regardless of how many lives you had left. If you remove all 28 grey squares, you move on to the next screen.

If all of this does not happen, and the machine crashes, reload the program and type in program 3, the hex checker, which will display the hex codes you entered; in columns similar to program 2. Compare the codes displayed with those in program 2, if a discrepancy is found, correct it by Poking the correct code directly; hex to decimal conversions are in the back of the Sinclair manual.

To help debugging here is a list of the locations of the more important routines.

16576 to 16614: extends a column of black rock
16615 to 16643: starts a bomb when '0' is pressed
16671 to 16750: moves this bomb
16751 to 16800: moves the UFO
16801 to 16843: moves UFO bombs
16854 to 16872: prints your laser base
16918 to 17034: sets up screen layout
17035 to 17118: main loop

To make the black rock advance faster Poke 17063,23 or Poke 17062,0 to make them advance slower.

To make the UFO fire more often, Poke 16790,23 or Poke 16789,0 to make them fire less often.

To slow the game down generally, Poke 17109 with a high number, or a two-byte number — greater than 256 — can be Poked into 17109 and 17110 by the method shown on page 177 of the ZX-81 manual. The original contents of 17109 and 17110 are 1 and 0 respectively. The byte at 17037 is 43 hex.

Program 1. The hex loader.

```
10 LET X$=""
15 FOR X=16514 TO 17305
20 SCROLL
25 PRINT AT 15,0;X;" ";
30 IF X$="" THEN INPUT X$
35 POKE X,16*CODE X$+CODE
   X$(2)-476
40 PRINT X$(TO 2)
45 LET X$=X$(3 TO)
50 NEXT X
```

Program 2. The hex codes.

```
16514 : 00 00 00 00 00 00 00 01
16522 : 00 00 C5 D5 2A 0C 40 23
16530 : 16 00 59 19 11 21 00 04
16538 : 05 28 03 19 10 FD D1 C1
16546 : 22 0E 40 C9 E5 2A 8B 43
16554 : 7E 23 22 8B 43 E1 C9 00
16562 : 00 00 ED 4B 25 40 51 14
16570 : C8 CD BD 07 7E C9 CD A6
16578 : 40 E6 1F 2A 0C 40 11 21
16586 : 00 19 16 00 5F 19 7E FE
16594 : 08 C0 11 21 00 19 7E FE
16602 : 80 20 02 18 F8 FE 16 D2
16610 : 09 43 36 80 C9 3A 82 40
16618 : FE 01 C8 ED 4B 83 40 06
16626 : 0E 0C 0C ED 43 84 40 CD
16634 : 8C 40 36 15 3E 01 32 82
16642 : 40 C9 2A 0C 40 11 5C 02
16650 : 19 7E 3C FE 26 20 05 36
16658 : 1C 2B 18 F5 77 2A 86 40
16666 : 23 22 86 40 C9 ED 4B 84
16674 : 40 CD 8C 40 36 00 05 CD
16682 : 8C 40 7E FE 80 20 0A 36
16690 : 00 AF 32 82 40 CD 04 41
16698 : C9 FE 08 20 1F 36 00 AF
16706 : 32 82 40 06 10 CD 8C 40
16714 : 36 88 06 0A CD 04 41 10
16722 : FB 21 88 40 34 7E FE 1C
16730 : C0 C3 25 43 78 FE 00 20
16738 : 05 AF 32 82 40 C9 36 15
16746 : ED 43 84 40 C9 2A 0C 40
16754 : 23 7E F5 E5 D1 23 01 1F
16762 : 00 ED B0 2B F1 77 2A 0C
16770 : 40 23 7E FE 14 20 FA 11
16778 : 21 00 19 7E FE 08 CB 3A
16786 : 89 40 17 17 00 00 47 CD
16794 : A6 40 BB D0 36 1B C9 2A
16802 : 0C 40 11 0F 02 19 7E FE
16810 : 12 C8 FE 1B 28 03 2B 18
16818 : F5 36 00 E5 11 21 00 19
16826 : 7E FE 00 20 05 36 1B E1
16834 : 18 EC FE 16 28 F9 E1 C3
16842 : 4F 43 16 81 A6 82 16 16
16850 : 17 1B 18 06 ED 4B 83 40
16858 : 06 0F CD 8C 40 11 CC 41
16866 : 01 05 00 EB ED B0 C9 B8
16874 : A8 B4 B7 AA 12 1C 1C 1C
16882 : 1C AD AE AC AD 12 00 00
16890 : 00 00 A8 A6 BB AA 12 1C
16898 : 1D B1 AA AB B9 12 1F 21
16906 : 82 40 06 07 36 00 23 10
16914 : FB 36 01 C9 01 00 12 CD
16922 : 8C 40 01 20 00 11 E9 41
16930 : EB ED B0 01 0F 12 CD 8C
16938 : 40 ED 4B BA 40 CD 98 0A
16946 : 0E 1D CD A6 40 E6 06 3C
16954 : 47 CD 8C 40 36 B0 10 F9
16962 : 11 00 05 1B 7A B3 20 FB
16970 : 0D 79 FE 02 20 E4 2A 0C
16978 : 40 06 20 23 36 00 10 FB
16986 : 23 23 23 23 06 1C 36 08
16994 : 23 10 FB 11 B0 01 19 06
17002 : 20 36 16 23 10 FB 23 23
17010 : 23 00 06 1C 36 BD 23 10
17018 : FB 01 00 00 CD 8C 40 3E
17026 : 13 D7 3E 14 D7 3E 12 D7
17034 : C9 CD 8D 43 CD 16 42 CD
17042 : D6 41 3A 82 40 FE 01 CC
17050 : 1F 41 CD 6F 41 CD A1 41
17058 : 3A 89 40 17 17 00 47 CD
17066 : A6 40 B8 DC C0 40 AF CD
17074 : B4 40 FE 1C CC E7 40 21
17082 : 83 40 FE 24 20 09 34 7E
17090 : FE 1C 20 01 35 18 0B FE
17098 : 21 20 07 35 7E FE FF 20
17106 : 01 34 11 01 00 1B 7A B3
17114 : 20 FB C3 91 42 2C 26 32
17122 : 2A 00 34 3B 2A 37 01 0B
17130 : 06 CD 8C 40 11 DF 42 01
17138 : 09 00 EB ED B0 2A 86 40
17146 : E5 ED 4B BA 40 ED 42 38
17154 : 04 E1 22 BA 40 CF FF 0E
17162 : 14 2A 0C 40 06 18 23 7E
17170 : FE 76 20 04 10 F8 18 05
17178 : EE 80 77 18 F1 0D 20 E9
17186 : C3 E8 42 2A 0C 40 06 10
17194 : 23 7E FE 76 20 04 10 F8
17202 : 18 04 36 00 18 F2 01 19
17210 : 12 CD 8C 40 CD 0B 41 21
17218 : 89 40 34 AF 32 88 40 CD
17226 : 32 42 C3 91 42 ED 4B 83
17234 : 40 06 0F CD 8C 40 11 D1
17242 : 41 01 05 00 EB ED B0 11
17250 : 00 60 1B 7A B3 20 FB 01
17258 : 1F 12 CD 8C 40 7E 3D 77
17266 : FE 1C CA E8 42 01 00 0F
17274 : CD 8C 40 06 20 36 16 23
17282 : 10 FB AF 32 83 40 C3 91
17290 : 42 00 00 3A 35 40 6F 26
17298 : 00 22 8B 43 CD 09 42 C9
```

Program 3. The hex checker.

```
10 FOR A=16514 TO 17305
15 PRINT A;": ";
20 FOR B=0 TO 7
25 PRINT CHR$ INT(PEEK
   (A+B)/16+28);CHR$
   (PEEK(A+B)-INT(PEEK
   (A+B)/16)*16+28);" ";
30 NEXT B
35 PRINT
40 LET A=A+7
45 NEXT A
50 NEXT X
```

Bertie

*C Stops,
Bridgwater,
Somerset.*



THIS IS A machine-code game for the 32K BBC computer. It is a totally original game, featuring a spider called Bertie. To enter the game, it is necessary to type in two listings. Type in the first one, Save it, and then type in the second, longer listing, and Save that too, preferably on the same cassette after the first program.

(continued on page 185)



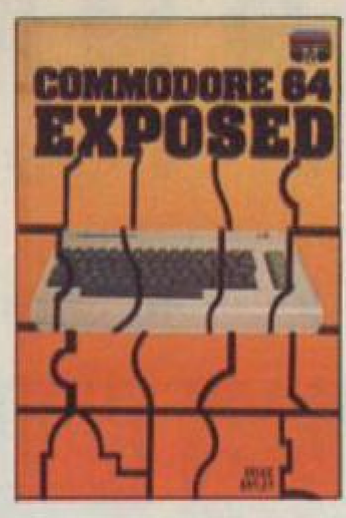
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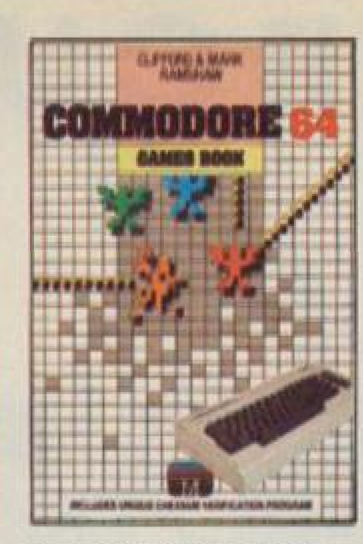
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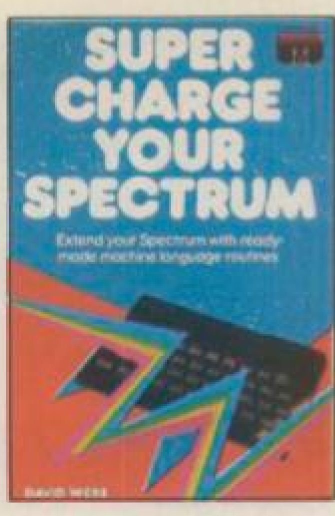
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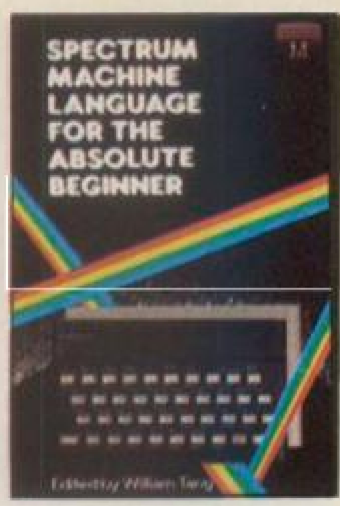
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..the name of the game

(continued from page 178)

When all is safely Saved, press Break, then, while still in Mode 7 — or the memory will run out — type

PAGE=&2000

Then Chain the first program you Saved. When it has run, Chain the second program too. When this has run, type

CALL &11A5

and Return. If all is well, instructions will come up. Pressing the space-bar will enable you to play with the keys, press fire to play on joysticks.

The keys are A — up; Z — down; O — left; P — right. Bertie must eat the files in the pipes to avoid starving. The amount of food energy inside him is shown in the bottom lines of the display. Every so often, one of the valves will open and the pipes will flood.

If Bertie is touched by the water, he will drown. He is more likely to be drowned if the middle valve opens, but there is a largish bias against this one opening. I did upgrade the game to include rats in the pipes, but the game was on the sluggish side.

This was because I used the OS calls for printing. I discovered a few days ago that Acorn does not use them, no doubt because its software would also not run fast enough. If the program did not work, you will have to check your listing. There are quite a few remarks in the assembler listing which should help. Pay especial attention to the & prefix on some numbers. If you have a good, working copy and would like to Save the code only, set page to &2000, Chain the first, then the second program. The type

*SAVE "BERTIE"D00 1B40 11A5

and Return. When it is on tape, to play the game, type

*RUN

and the computer will do the rest.

Listing 1.

```
10REM A%=STARV
20REM C%=CHARACTERS
30REM D%=DROWN
40REM E%=ENVELOPES
50REM I%=INSTRUCTIONS
60REM K%=LIVES,SCORE,FOOD
70REM L%=LOOP
80REM M%=LOOP
90REM O%=OVER
100REM P%=PROGRAM COUNTER
110REM R%=POST MORTEM
120REM S%=SOUND
130REM T%=PIPES
140P%=&D00:RESTORE:REM INSTRUCTIONS
170I%=P%:REPEAT:READ A$:IFA$="N" ?P%=&D:P%=P%+1:GOTO 260
210IF A$="                BERTIE" ?P%=130:P%=P%+1:?P%=141:P%=P%+1 ELSE ?P%=131:P%=P%+1
220FOR L%=1 TO LEN(A$):?P%=ASC(MID$(A$,L%,1)):P%=P%+1:NEXT:IF LEN(A$)<39 ?P%=&D:P%=P%+1
260UNTILRIGHT$(A$,11)="GOOD LUCK !":?P%=0:P%=P%+1:REM CHAR DEFINITIONS
300C%=P%:REPEAT:READ A%:?P%=A%:P%=P%+1:UNTILA%=99:REM ENVELOPES
370E%=P%:FOR L%=1 TO 14:READ A%:?P%=A%:P%=P%+1:NEXT:REM PIPES
430T%=P%:FOR L%=1 TO 23:READ A$:FOR M%=1 TO 20:IF MID$(A$,M%,1)="O" ?P%=129 ELSE IF MID$(A$,M%,1)="+" ?P%=133 ELSE ?P%=130
480P%=P%+1:NEXT:NEXT:?P%=0:P%=P%+1:REM LIVES ETC
530K%=P%:FOR M%=1 TO 3:READ A$:FOR L%=1 TO 10:?P%=ASC(MID$(A$,L%,1)):P%=P%+1:NEXT:?P%=&0D:P%=P%+1:NEXT:P%=P%-1:REM SOUND
650S%=P%:FOR L%=1 TO 32:READ A%:?P%=A%:P%=P%+1:NEXT:REM MORTEM DATA
720R%=P%:READ A$:FOR L%=1 TO LEN(A$):?P%=ASC(MID$(A$,L%,1)):P%=P%+1:NEXT:REM DROWN/STARV/END DATA
790D%=P%:READ A$:FOR L%=1 TO LEN(A$):?P%=ASC(MID$(A$,L%,1)):P%=P%+1:NEXT:A%=P%:READ A$:FOR L%=1 TO LEN(A$):?P%=ASC(MID$(A$,L%,1)):P%=P%+1:NEXT:O%=P%:READ A$:FOR L%=1 TO LEN(A$):?P%=ASC(MID$(A$,L%,1)):P%=P%+1:NEXT
970DATA "                BERTIE"
980DATA "                BERTIE"
990DATA "Bertie the spider lives in the plumbing"
1000DATA "of an old, tumbledown house. He's a"
1010DATA "money spider, but his fortune has"
1020DATA "unfortunately (get the pun ?) changed"
1030DATA "for the worst. Every so often, someone"
1040DATA "called Beeb opens the valves, and water"
1050DATA "flows into the pipes. This means that"
1060DATA "Bertie has to be careful, or he will"
1070DATA "drown. On the other hand, he must"
1080DATA "venture into the pipes to eat the flies"
1090DATA "or he will die of starvation !"
1100DATA "N"
1110DATA "PRESS SPACE BAR OR FIRE             "
1120DATA "N"
1130DATA "GOOD LUCK !"
1140DATA 23,224,0,255,255,24,24,24,24,24,23,225,241,138,138,78,126,120,100,18,23,226,126,255,219,255,126,228,4,7,23,227,126,255,219,255,126,39,32,224,23,228,0,&12,&31,&50,&FD,&7E,&64,&0C,23,229,0,&12,&31,&50,&FD,&7E,&2C,&40
1141DATA 23,230,0,&48,&EC,&8A,&BF,&7E,&26,&30,23,231,0,&48,&0C,&8A,&BF,&7E,&34,&0C,99
1150DATA 1,128,-10,0,0,10,0,0,126,0,0,-1,126,126
1160DATA "    OOOOO           "
1170DATA "    OOOOO           "
1180DATA "    OOOOO           "
1190DATA "      O             "
1200DATA "O       OOOOOO      "
1210DATA "O            O      "
1220DATA "O            O      "
1230DATA "O OOOOOOOOOOO+      "
1240DATA "O O          C      "
1250DATA "OOO          C      "
1260DATA "  O          C      "
1270DATA "  OOOOOOOOOOOO      "
1280DATA "         O   O      "
1290DATA "         O   O      "
1300DATA "        OOOOOOOOOOO+O"
1310DATA "      O             "
1320DATA "      O             "
1330DATA "OOOOOOOOOOOOOO      "
1340DATA "O   O   O   O       "
1350DATA "O   O   O   O       "
1360DATA "O   O   O   O       "
1370DATA "O   O   O   O       "
1380DATA "OOOOOOOOOOOOOOOOOO+O"
1390DATA "SCORE.....","FOOD......","LIVES....."
1400DATA 1,0,1,0,20,0,3,0,0,0,&F1,&FF,4,0,1,0,&12,0,0,0,0,0,0,0,&12,0,&F1,&FF,0,0,&FF,&FF
1410DATA "SCORE:Bertie died from"
1420DATA "drowning","starvation"
1430DATA "GAME  OVER"
```

Listing 2.

```
10XSTEPS=32:YSTEPS=16:TEXCOLS=6:FOR PAS%=1 TO 3 STEP 2:P%=&11A5:[:OPT PAS%:JSR INIT:JSR INSTRUCT:JSR CONTROLS:LDA#22:JSR&FFEE:LDA#2:JSR&FFEE:LDA #23:JSR&FFEE:LDA#0:JSR&FFEE:LDA#10:JSR&FFEE:LDA#32:JSR&FFEE:LDA#0:JSR&FFEE:JSR&FFEE:JSR&FFEE
270JSR&FFEE:JSR&FFEE:JSR&FFEE:JSR SETCOLS:.MEGALOOP:JSR SETSCORE:.LIVELEFT:JSR PIPES:JSR SETVARS:JSR PRINBERT:JSR NEWFLY:.MAINLOOP JSR CHANGEVALVES:LDA&79:CLC:ADC&7A:ADC#0:BEQ NOFLOODMAINLOOP:JSR FLOOD:.NOFLOODMAINLOOP:JSR CHEKDEAD
470LDA&70:BNE ENDLOOP:JSR MOVBERT:JSR CHEKDEAD:JSR DECFOOD:LDA&86:CLC:ADC&87:ADC#0:BNE FLYTHERE:JSR RANDOMISER:CMP#4:BCS FLYTHERE:JSR NEWFLY:.FLYTHERE:LDA&70:BNE ENDLOOP:LDA&72:BNE MAINLOOP:LDA&71:BNE MAINLOOP:.ENDLOOP
640LDY#(S%+16)DIV256:LDX#(S%+16)MOD256:LDA#7:JSR&FFF1\SOUND OFF:JSR POSTMORTEM:LDA&73:BNE LIVELEFT:JSR CONTROLS:JMP MEGALOOP:.INIT:LDY#0:.INITLOOP1:LDA C%,Y:CMP#99:BEQ ENVS:JSR&FFEE:INY:JMP INITLOOP1:.ENVS:LDX#E%MOD256:LDY#E%DIV256:LDA#8:JSR&FFF1
840RTS:.INSTRUCT:LDA#22:JSR&FFEE:LDA#7:JSR&FFEE\MODE 7:LDA#I%MOD256:STA&74:LDA#I%DIV256:STA&75:LDY#0:.LOOPINST1 LDA(&74),Y:BEQ ALLPRINTED:JSR&FFE3:INY:BNE LOOPINST1:INC&75:JMP LOOPINST1:.ALLPRINTED RTS:.CONTROLS:LDX#&9D:JSR CHEKKEYCALL
1060BEQ NOKEYS:LDA#1:STA&909:RTS:.NOKEYS JSR BUTTON:BEQ NOBUTTON:LDA#0:STA&909:RTS:.NOBUTTON JMP CONTROLS:.BUTTON:LDA#128:LDX#0:JSR&FFF4:TXA:AND#1:RTS:.SETSCORE:LDA#3:STA&73:LDA#0:STA&76:STA&77:RTS:.SETCOLS:LDY#0:.SETCOLSLOOP1 LDA #19
1240JSR&FFEE:LDA#15:STY&76:SEC:SBC&76:JSR&FFEE:TYA:JSR&FFEE:LDA#0:JSR&FFEE:JSR&FFEE:JSR&FFEE:INY:CPY#8:BNE SETCOLSLOOP1:\COLOUR 14-4:LDA#19:JSR&FFEE:LDA#14:JSR&FFEE:LDA#4:JSR&FFEE:LDA#0:JSR&FFEE:JSR&FFEE:JSR&FFEE:RTS:.PIPES:LDA#17:JSR&FFEE
1540LDA#130:JSR&FFEE:LDA#12:JSR&FFEE:LDA#31:JSR&FFEE:LDA#0:JSR&FFEE:LDA#5:JSR&FFEE:LDA#T%MOD256:STA&74:LDA#T%DIV256:STA&75:LDY#0:.PIPLOOP1 LDA(&74),Y:BEQ PIPEND:PHA:LDA#17:JSR&FFEE:PLA:JSR&FFEE:LDA#32:JSR&FFEE:INY:BNE PIPLOOP1:INC&75
1810JMP PIPLOOP1:.PIPEND:LDA#17:JSR&FFEE:LDA#0:JSR&FFEE:LDA#17:JSR&FFEE:LDA#130:JSR&FFEE:LDA#31:JSR&FFEE:LDA#13:JSR&FFEE:LDA#11:JSR&FFEE:LDA#224:JSR&FFEE:LDA#31:JSR&FFEE:LDA#18:JSR&FFEE:JSR&FFEE:LDA#224:JSR&FFEE:LDA#31:JSR&FFEE:LDA#18
2090JSR&FFEE:LDA#26:JSR&FFEE:LDA#224:JSR&FFEE:\-LIVES ETC-:LDA#17:JSR&FFEE:LDA#130:JSR&FFEE:LDA#17:JSR&FFEE:LDA#TEXCOLS:JSR&FFEE:LDA#31:JSR&FFEE:LDA#0:JSR&FFEE:LDA#29:JSR&FFEE:LDY#0:.LIVELOOP1:LDA K%,Y:JSR&FFE3:INY:CPY#32:BNE LIVELOOP1
2360LDA#226:LDY&73:.LIVESLOOP1 JSR&FFEE:DEY:BNE LIVESLOOP1:RTS:.SETVARS:LDA#226:STA&78:LDA#5:STA&71\FOOD HI BYTE:LDA#0:STA&70:STA&72:STA&79:STA&7A:STA&7B:STA&7C:STA&7D:STA&7E\SHUT VALS:LDA#384MOD256:STA&7F:LDA#384DIV256:STA&80:LDA#831MOD256
2550STA&81:LDA#831DIV256:STA&82:RTS:.PRINBERT:LDA#25:JSR&FFEE:LDA#4:JSR&FFEE:LDA&7F:JSR&FFEE:LDA&80:JSR&FFEE:LDA&81:JSR&FFEE:LDA&82:JSR&FFEE:LDA#18:JSR&FFEE:LDA#3:JSR&FFEE:LDA#1:JSR&FFEE:LDA#5:JSR&FFEE:LDA&78:JSR&FFEE:LDA#4:JSR&FFEE:RTS
2850.NEWFLY:JSR RANDOMISER:AND#&F:CLC:ADC#2:\*64:PHA:LSR A:LSR A\HI:STA&85:PLA\LO:ASL A:ASL A:ASL A:ASL A:ASL A:ASL A\2 MSB'S:STA&84:JSR RANDOMISER\Y CO-ORD:AND#7:CLC:ADC#4:\*32:PHA:LSR A:LSR A:LSR A\HI:STA&87:PLA\LO
3040ASL A:ASL A:ASL A:ASL A:ASL A:SEC:SBC#1:STA&86:LDA&87:SBC#0:STA&87:LDY#0:LDX#&84:LDA#9:JSR&FFF1:LDA&88:CMP#1\RED PIPE ?:BEQ FLYEND:CMP#14\UNDER WATER ?:BNE NEWFLY:.FLYEND\PRINT:LDA#25:JSR&FFEE:LDA#4:JSR&FFEE:LDA&84:JSR&FFEE:LDA&85
3290JSR&FFEE:LDA&86:JSR&FFEE:LDA&87:JSR&FFEE:LDA#5:JSR&FFEE:LDA#18:JSR&FFEE:LDA#3:JSR&FFEE:LDA#7:JSR&FFEE:LDA#225:JSR&FFEE:LDA#4:JSR&FFEE:LDY#S%DIV256:LDX#S%MOD256:LDA#7:JSR&FFF1\SING NOISE:RTS:.CHANGEVALVES:JSR RANDOMISER:CMP#2
3530BCS ENDCHANGEVALS:LDA&79:CLC:ADC&7A\FLOOD LEVEL 0 ?:ADC#0:BNE ENDCHANGEVALS:\SO IF WE'RE HERE, OPEN A VALVE
3600JSR RANDOMISER:AND#1:STA&7C\BERT'S:JSR RANDOMISER\RATE OF FLOOD:AND#1:CLC:ADC#1\CAN'T HAVE 0:STA&8A:JSR RANDOMISER:CMP#20:BCS BOTVALVE:LDA#1:STA&7D:STA&7A\FLOOD LEVEL:LDA#128:STA&79:JMP ENDCHANGEVALS:.BOTVALVE:LDA#1:STA&7E:LDA#0
3790STA&7A\SET LEVEL OF FLOOD:LDA#128:STA&79:.ENDCHANGEVALS JSR UPDATE:RTS:.UPDATE:LDA#17:JSR&FFEE:LDA#130:JSR&FFEE:LDA#17:JSR&FFEE:LDA#3:JSR&FFEE:LDA#31:JSR&FFEE:LDA#15:JSR&FFEE:LDA#11:JSR&FFEE:LDA&7C:BEQ V1SHUT:JSR OPEN:JMP V1LOOP
4020.V1SHUT JSR SHUT:.V1LOOP:LDA#31:JSR&FFEE:LDA#15:JSR&FFEE:LDA#16:JSR&FFEE:LDA&7D:BEQ V2SHUT:JSR OPEN:JMP V2LOOP:.V2SHUT JSR SHUT:.V2LOOP:LDA#31:JSR&FFEE:LDA#15:JSR&FFEE:LDA#24:JSR&FFEE:LDA&7E:BEQ V3SHUT:JSR OPEN:JMP V3LOOP
4260.V3SHUT JSR SHUT:.V3LOOP:RTS:.OPEN:LDA#ASC"O":JSR&FFEE:LDA#ASC"P":JSR&FFEE:LDA#ASC"E":JSR&FFEE:LDA#ASC"N":JSR&FFEE:RTS:.SHUT:LDA#ASC"S":JSR&FFEE:LDA#ASC"H":JSR&FFEE:LDA#ASC"U":JSR&FFEE:LDA#ASC"T":JSR&FFEE:RTS:.FLOOD:LDA&8A:STA&75\RATE OF FLOOD
4510.FLOODLOOP1:LDA&7D\MIDDLE VALVE:BNE DOUBLE:JMP NORMALFLOOD:.DOUBLE:\IF HERE,DOUBLE
4570LDA#25:JSR&FFEE:LDA#4:JSR&FFEE:LDA#0:JSR&FFEE:JSR&FFEE:LDA&79:JSR&FFEE:LDA&7A:JSR&FFEE:LDA#25:JSR&FFEE:LDA#6:JSR&FFEE:LDA#1279MOD256:JSR&FFEE:LDA#1279DIV256:JSR&FFEE:LDA&79:JSR&FFEE:LDA&7A:JSR&FFEE:LDA#25\OTHER LINE:JSR&FFEE:LDA#4:JSR&FFEE
4840LDA#0:JSR&FFEE:JSR&FFEE:LDA#252:SEC:SBC&79:PHP:JSR&FFEE:LDA#2:PLP:SBC&7A:JSR&FFEE:LDA#25:JSR&FFEE:LDA#6:JSR&FFEE:LDA#1279MOD256:JSR&FFEE:LDA#1279DIV256:JSR&FFEE:LDA#252:SEC:SBC&79:PHP:JSR&FFEE:LDA#2:PLP:SBC&7A:JSR&FFEE:JMP FLOODEND
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5620DEC&79:DEC&79:DEC&79:DEC&79:LDA#0:STA&7D:STA&7E\SHUT VALS:JSR UPDATE:.NO640:LDA&7A\SOUND:ASL A:ASL A:ASL A:ASL A:ASL A:ASL A:STA&74:LDA&79:LSR A:LSR A:CLC:ADC&74:STA 28+S%:LDY#(24+S%)DIV256:LDX#(24+S%)MOD256:LDA#7:JSR&FFF1
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5870.FLOODINGLOOPEND RTS:.CHEKDEAD:JSR CHEK_TL:CPX#8:BCC NODEAD1:INC&70:.NODEAD1 JSR CHEK_BL:CPX#8:BCC NODEAD2:INC&70:.NODEAD2 RTS:.CHEK_TL:LDY#0:LDX#&7F:LDA#9:JSR&FFF1:LDX&83:RTS:.CHEK_TR:LDA&80:PHA:LDA&7F:PHA:CLC:ADC#63:STA&7F
6110LDA&80:ADC#0:STA&80:LDY#0:LDX#&7F:LDA#9:JSR&FFF1:LDX&83:PLA:STA&7F:PLA:STA&80:RTS:.CHEK_BR LDA&82:PHA:LDA&81:PHA:SEC:SBC#31:STA&81:LDA&82:SBC#0:STA&82:LDA&80:PHA:LDA&7F:PHA:CLC:ADC#63:STA&7F:LDA&80:ADC#0:STA&80:LDY#0:LDX#&7F:LDA#9
6390JSR&FFF1:LDX&83:PLA:STA&7F:PLA:STA&80:PLA:STA&81:PLA:STA&82:RTS:.CHEK_BL:LDA&82:PHA:LDA&81:PHA:SEC:SBC#31:STA&81:LDA&82:SBC#0:STA&82:LDY#0:LDX#&7F:LDA#9:JSR&FFF1:LDX&83:PLA:STA&81:PLA:STA&82:RTS:.MOVBERT
6610LDA#&64:STA&74:STA&75\SET KEYS:LDA&909:BEQ CHEKSTIK:JSR CHEKKEYS:JMP CHEKED:.CHEKSTIK JSR CHECKSTIK:.CHEKED:LDA&74:CLC:ADC&75:CMP#128:BNE KEYPRESSED:JMP MOVBERTEND:.KEYPRESSED:LDA&80:PHA:LDA&7F:PHA:BIT&74:BVS XSTEPOK1:BPL GOESRIGHT
6820\IF WERE HERE, GOES LEFT
6830SEC:SBC#XSTEPS:STA&7F:LDA&80:SBC#0:STA&80:JMP XSTEPOK1:.GOESRIGHT:CLC:ADC#XSTEPS:STA&7F:LDA&80:ADC#0:STA&80:.XSTEPOK1:LDA&82:PHA:LDA&81:PHA:BIT&75:BVS YSTEPOK1:BPL GOESUP:\DOWN:SEC:SBC#YSTEPS:STA&81:LDA&82:SBC#0:STA&82:JMP YSTEPOK1
7070.GOESUP:CLC:ADC#YSTEPS:STA&81:LDA&82:ADC#0:STA&82:.YSTEPOK1:\BERT GO THERE ?:JSR CHEK_TL:CPX#2:BNE OK6:JMP USNM:.OK6:CPX#255:BNE OK7:JMP USNM:.OK7:CPX#13:BNE OKE:JMP USNM:.OKE:CPX#5:BNE NOINTAP:LDA&7C:BNE NOINTAP:JMP USNM:.NOINTAP
7330JSR CHEK_TR:CPX#2:BNE OK8:JMP USNM:.OK8:CPX#255:BNE OK9:JMP USNM:.OK9:CPX#13:BNE OKF:JMP USNM:.OKF:CPX#5:BNE NOINTAP2:LDA&7C:BNE NOINTAP2:JMP USNM:.NOINTAP2:JSR CHEK_BR:CPX#2:BNE OKA:JMP USNM:.OKA CPX#13:BNE OKC:JMP USNM:.OKC
7600JSR CHEK_BL:CPX#2:BNE OKB:JMP USNM:.OKB CPX#13:BNE OKD:JMP USNM:.OKD:\RUB OUT OLD BERT-USE PAGE 9%:PLA:STA&902:PLA:STA&903:PLA:STA&900:PLA:STA&901:LDA#25:JSR&FFEE:LDA#4:JSR&FFEE:LDA&900:JSR&FFEE:LDA&901:JSR&FFEE:LDA&902:JSR&FFEE:LDA&903
7840JSR&FFEE:LDA#18:JSR&FFEE:LDA#3:JSR&FFEE:LDA#1:JSR&FFEE:LDA#5:JSR&FFEE:LDA&78:JSR&FFEE:LDA#4:JSR&FFEE:LDA&78\CHANGE BERT:EOR#1:STA&78:\EATEN A FLY ?:JSR CHEK_TL:CPX#6:BNE NOEATFLY:\DO FOOD & FLY:LDA#25:JSR&FFEE:LDA#4:JSR&FFEE:LDA&84
8100JSR&FFEE:LDA&85:JSR&FFEE:LDA&86:JSR&FFEE:LDA&87:JSR&FFEE\MOVE TO FLY'S CO-ORDS:LDA#18:JSR&FFEE:LDA#3:JSR&FFEE:LDA#7:JSR&FFEE:LDA#5:JSR&FFEE:LDA#225:JSR&FFEE:LDA#4:JSR&FFEE:SED:LDA&71\FOOD:CLC:ADC#1:STA&71:\NOW INC SCORE:LDA&77:CLC
8370ADC#&10:STA&77:LDA&76:ADC#0:STA&76:CLD:LDA#0:STA&86:STA&87:.NOEATFLY:JSR PRINBERT:LDY#(S%+8)DIV256:LDX#(S%+8)MOD256:LDA#7:JSR&FFF1:JMP MOVBERTEND:.USNM:PLA:STA&81:PLA:STA&82:PLA:STA&7F:PLA:STA&80:.MOVBERTEND:.CHEKKEYS:LDX#&BE
8530JSR CHEKKEYCALL:BEQ NOUP:LDA#1:STA&75:.NOUP LDX #&9E:JSR CHEKKEYCALL:BEQ NODOWN:LDA#129:STA&75:.NODOWN LDX #&C8:JSR CHEKKEYCALL:BEQ NORIGHT:LDA#1:STA&74:.NORIGHT LDX#&C9:JSR CHEKKEYCALL:BEQ NOLEFT:LDA#129:STA&74:.NOLEFT RTS
8730.CHEKKEYCALL:LDY#&FF:LDA#&81:JSR&FFF4:TXA:RTS:.CHECKSTIK:LDX#1:JSR CHEKBIG:BCC NOLEFT1:LDA#129:STA&74:.NOLEFT1 LDX#1:JSR CHEKSMAL:BCS NORIGHT1:LDA#1:STA&74:.NORIGHT1 LDX#2:JSR CHEKBIG:BCC NOUP1:LDA#1:STA&75:.NOUP1 LDX#2:JSR CHEKSMAL
8970BCS NODOWN1:LDA#129:STA&75:.NODOWN1 RTS:.CHEKBIG:LDA#128:JSR&FFF4:CPY#&D8:RTS:.CHEKSMAL:LDA#128:JSR&FFF4:CPY#39:RTS:.DECFOOD:SED:LDA&72:SEC:SBC#1:STA&72:LDA&71:SBC#0:STA&71:CLD:\NOW PRINT BOTTOMLINE:LDA#17:JSR&FFEE:LDA#130
9230JSR&FFEE\SET BACKGROUND:LDA#17:JSR&FFEE:LDA#TEXCOLS:JSR&FFEE\FOREGROUND:LDA#31:JSR&FFEE:LDA#10:JSR&FFEE:LDA#29:JSR&FFEE:LDA&76\HI BYTE SCORE:PHA:AND#&F0:LSR A:LSR A:LSR A:LSR A:CLC:ADC#48:JSR&FFEE:PLA:AND#&0F:CLC:ADC#48:JSR&FFEE
9460LDA&77\LO BYTE SCORE:PHA:AND#&F0:LSR A:LSR A:LSR A:LSR A:CLC:ADC#48:JSR&FFEE:PLA:AND#&0F:CLC:ADC#48:JSR&FFEE\SCORE DONE:LDA#31:JSR&FFEE:LDA#10:JSR&FFEE:LDA#30:JSR&FFEE:LDA&71\HI BYTE FOOD:PHA:AND#&F0:LSR A:LSR A:LSR A:LSR A:CLC:ADC#48
9700JSR&FFEE:PLA:AND#&0F:CLC:ADC#48:JSR&FFEE:LDA&72:PHA:AND#&F0:LSR A:LSR A:LSR A:LSR A:CLC:ADC#48:JSR&FFEE:PLA:AND#&0F:CLC:ADC#48:JSR&FFEE\FOOD DONE:RTS:.POSTMORTEM:LDA#20\DELAY TIME:JSR DELAY:LDA#17:JSR&FFEE:LDA#130:JSR&FFEE:LDA#12:JSR&FFEE
9980LDA#17:JSR&FFEE:LDA#0:JSR&FFEE:LDA#31:JSR&FFEE:LDA#5:JSR&FFEE:LDA#7:JSR&FFEE:LDY#0:.MORTEMLOOP1 LDA R%,Y:JSR&FFEE:INY:CMP#ASC":":BNE MORTEMLOOP1:\PRINT SCORE:LDA&76:PHA:AND#&F0:LSR A:LSR A:LSR A:LSR A:CLC:ADC#48:JSR&FFEE:PLA:AND#&0F:CLC
10250ADC#48:JSR&FFEE:LDA&77:PHA:AND#&F0:LSR A:LSR A:LSR A:LSR A:CLC:ADC#48:JSR&FFEE:PLA:AND#&0F:CLC:ADC#48:JSR&FFEE:LDA#31:JSR&FFEE:LDA#3:JSR&FFEE:LDA#10:JSR&FFEE:.MORETEXT LDA R%,Y:JSR&FFEE:INY:CMP#ASC"m":BNE MORETEXT:LDA#31:JSR&FFEE:LDA#5
10530JSR&FFEE:LDA#12:JSR&FFEE:LDA&71:CLC:ADC&72:ADC#0:BEQ STARVATION:LDY#0:.DROWNLOOP LDA D%,Y:JSR&FFEE:INY:CMP#ASC"g":BNE DROWNLOOP:JMP MORTLOOPEND:.STARVATION:LDY#0:.STARVLOOP LDA A%,Y:JSR&FFEE:INY:CMP#ASC"n":BNE STARVLOOP:.MORTLOOPEND
10760DEC&73\LOSES LIFE:BNE LIVESLEFT:LDA#31:JSR&FFEE:LDA#5:JSR&FFEE:LDA#20:JSR&FFEE:LDY#0:.OVERLOOP LDA O%,Y:JSR&FFEE:INY:CMP#ASC"R":BNE OVERLOOP:.LIVESLEFT:LDA #20:JSR DELAY:RTS:.DELAY:.OUTERLOOP LDX #255:.OUTER LDY #255:.INNER DEY
10980BNE INNER:DEX:BNE OUTER:SEC:SBC#1:BNE OUTERLOOP:RTS:.RANDOMISER:TXA:PHA:TYA:PHA:LDY#9:LDX#&89:LDA#1:JSR&FFF1:PLA:TAY:PLA:TAX:LDA&89:ADC&72:ADC&7F:ADC&84:ADC&904:STA&89:RTS:]:NEXT
```

Duck soup

David Rees,
Weybridge,
Surrey.

CBM-64

DUCK SHOOT IS A fast arcade-type game for the Commodore 64 with a joystick. The object of the game is to shoot down ducks that are flying overhead. The higher the duck that is shot, the more points you gain, and after 30 seconds your final score is given.

The interesting point of this game is its

(continued on page 187)


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JUMBLY 48K

(continued from page 185)

speed, over 60 moves per second. This can be increased to over 100 moves per second, when you have mastered the game, simply by lowering the number Poked in line 390. Speed is achieved by using IRQ — interrupt request. This normally gets a key and changes TI, but by wedging machine code before the routine, the sprites are moved every time an IRQ is called.

The IRQ is triggered by a clock counting down from a value to zero. Poking 56325 sets this value, so the lower it is, the shorter the delay time and the faster the sprites move.

A Basic routine is also used. This handles score and time printing and checks if a collision occurs. Thus, there is a limit as to how fast sprite movements can be.

To use the program, simply Run it. The routine will first Poke machine code and graphics to memory, and then start a test game. After this, games are played normally, and start when you press Y. Please note that the joystick should be plugged into port 2.

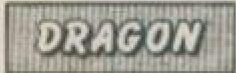
Unfortunately, the program is almost impossible to convert to other micros, as it uses so much machine code and many of the CBM-64's special features. The only sensible things that can be transferred are the principles of the game and the idea behind the speed.

As always with machine code, Save a copy of the program before trying it, as any mistake could cause a system crash, and loss of the program. This precaution may seem excessive but the resulting game is well worth the effort.

```
1 REM* DUCK SHOOT  *
2 REM*BY DAVID REES*
10 V=53248:POKEV+32,6:POKEV+33,0:R=50432
15 W=51968:POKE54296,15
20 POKEV+21,255:POKE56325,255:POKEV+23,1
25 IFPEEK(49152)<>169THENGOSUB100
30 S=0:Q=0:SYS49675:FORN=2TO5
40 POKE2040+N,253:POKEV+39+N,0
50 X=(N-2)*128:POKEV+N*2,XAND255
60 IFINT(X/256)=1THENQ=Q+2↑N
70 POKEV+1+N*2,100:POKE52224+N*2,1
80 NEXT
90 POKEV+29,252
95 GOTO300
99 REM*CODE GET SUBROUTINE*
100 FORN=0TO2
110 FORM=0TO63
120 READA:IFA=-1THEN150
130 POKE16192+N*64+M,A
140 NEXTM
150 FORP=MTO63
160 POKE16192+N*64+P,0
170 NEXTP,N
180 FORN=0TO5
190 FORM=0TO255
200 READA:IFA=-1THEN230
210 POKE49152+N*256+M,A
220 NEXTM
230 NEXTN
299 RETURN
300 FORN=6TO7
310 POKE2040+N,253:POKEV+39+N,0
320 X=(N-6)*256:POKEV+N*2,XAND255
330 IFINT(X/256)=1THENQ=Q+2↑N
340 POKEV+1+N*2,60:POKE52224+N*2,2
350 NEXT
360 POKEV+16,Q:SYS49664
370 SS=54272:POKESS+10,0:POKESS+14,255
380 POKESS+15,255:POKESS+18,129
389 REM*SPEED SET*
390 POKE56325,55
400 POKE2041,255:POKE2040,254
410 POKEV,255:POKEV+1,238
420 POKEV+39,5:POKEV+40,4
430 TI$="000000":L=53278
450 PRINT"   TIME=       SCORE      "
460 P=PEEK(L)
499 REM*MAIN ROUTINE*
500 SYSR:PRINT"  "INT((1800-TI)/60)"  ";S
510 IFTI>1770THEN900
520 P=PEEK(L):IFP=0THEN500
550 IFPAND2=0THEN500
599 REM*HAS A DUCK BEEN HIT?*
600 SYS49920
610 A=PEEK(W+2):B=PEEK(W+3):C=PEEK(W+16)AND2
615 IFC=2THENC=256
620 FORX=2TO7
630 Y=PAND(2↑X):IFY=0THEN800
640 D=PEEK(W+16)AND(2↑X):IFD<>0THEND=256
650 T=-PEEK(W+2*X)+A-D+C
660 IFT<-8ORT>40THEN800
670 T=B-PEEK(W+2*X+1)
680 IFT<-8ORT>40THEN800
689 REM*YES*
690 POKE52226,0:POKEV+3,0
700 S=S+164-PEEK(W+2*X+1)
705 POKEV+21,PEEK(V+21)AND(255-2↑X)
710 FORN=0TO3
780 NEXTN
790 GOTO500
800 NEXT
810 GOTO500
900 PRINT"                  "
910 PRINT"WELL DONE"
950 POKE52226,0:POKEV+3,0
960 FORN=0TO3999:NEXT
970 PRINT"WOULD YOU LIKE ANOTHER GAME"
980 GETA$:IFA$="Y"THEN20
990 IFA$<>"N"THEN980
995 END
4999 REM*SPRITE GRAPHICS*
5000 DATA,,,1,128,,7,192,,5,192,,63,192,
5010 DATA15,224,16,63,224,32,15,255,224
5020 DATA1,255,192,1,255,192,3,255,192
5030 DATA3,255,192,3,255,192,1,255,128
5040 DATA1,255,128,,254,-1
5100 DATA12,,,12,,,63,,,63,,,255,192,
5110 DATA255,192,-1
5200 DATA224,,,224,,,224,,,224,,
5210 DATA224,,,224,,,224,,,224,-1
5249 REM*MACHINE CODE*
5250 DATA169,4,133,255,160,4,173,16,208
5260 DATA37,255,201,,240,16,185,,208,24
5270 DATA105,80,144,8,173,21,208
5280 DATA5,255,141,21,208,6,255,208,208
5290 DATA192,16,208,223
5300 DATA173,2,204,240,17,173,3,208,56
5310 DATA233,40,176,8,169,,141,2,204,141,3,208
5320 DATA24,173,,220,133,251,41,16,201,
5330 DATA208,49,173,2,204,208,44,32,,196,169,8
5340 DATA141,2,204,173,,208,141,2,208
5350 DATA169,190,141,3,208,173,16,208
5360 DATA41,1,201,,240,2,169,2,133,252
5370 DATA173,16,208,41,253,24,101,252,24
5380 DATA141,16,208,165,251,41,4,201,
5390 DATA208,51,173,,208,56,233,4
5400 DATA176,14,141,,208,173,16,208
5410 DATA73,1,141,16,208,24,144,4,24
5420 DATA141,,208,173,16,208,41,1,201,
5430 DATA240,1,96,173,,208,56,233,50
5440 DATA176,5,169,51,141,,208,24,96
5450 DATA165,251,41,8,201,
5460 DATA240,1,96,173,,208,24,105,4
5470 DATA144,15,24,141,,208,173,16,208
5480 DATA73,1,141,16,208,24,144,3
5490 DATA141,,208,173,16,208,41,1,201,
5500 DATA208,1,96,173,,208,56,233,51
5510 DATA144,6,24,169,50,141,,208,96,-1
5515 REM
5520 DATA238,,205,173,,205,205,1,205
5530 DATA208,5,169,,141,,205,169,4
5540 DATA133,255,160,4,185,,204,240,64
5550 DATA201,1,208,29,185,,208,56,233,2
5560 DATA176,14,153,,208,173,16,208
5570 DATA69,255,141,16,208,24,144,38
5575 DATA24,153,,208,24,144,31
5580 DATA201,2,208,27,185,,208,24,105,2
5590 DATA144,15,24,153,,208,173,16,208
5600 DATA69,255,141,16,208,24,144,3
5610 DATA153,,208,24,6,255,200,200
5620 DATA192,16,208,179,,73,2,204
5630 DATA240,10,173,3,208,56,233,3,24
5640 DATA141,3,208,76,49,234,-1
5700 DATA169,193,141,21,3,169,,141,20,3
5710 DATA96
5720 DATA169,234,141,21,3,169,49,141,20,3
5730 DATA96,-1
5800 DATA160,,185,,208,153,,203,200
5810 DATA192,17,208,245,96,-1
5900 DATA169,,141,4,212,169,10
5910 DATA141,5,212,169,1,141,6,212
5920 DATA169,129,141,4,212,169,50
5930 DATA141,1,212,96,-1
6000 DATA160,4,132,255,173,16,208,37,255
6010 DATA201,,240,21,185,,208,24,105,10
6020 DATA144,13,24,173,27,212,41,31,24
6030 DATA105,132,24,153,1,208,6,255,200
6040 DATA200,192,12,208,218
6050 DATA173,27,212,41,4,133,253
6060 DATA173,12,208,24,105,3,144,15,24
6070 DATA141,12,208,173,16,208,73,64
6080 DATA141,16,208,24,144,3,141,12,208
6090 DATA173,14,208,24,105,3,144,15,24
6100 DATA141,14,208,173,16,208,73,128
6110 DATA141,16,208,24,144,3,141,14,208
6120 DATA76,,192,-1
```

Blocks

Mark Sadler,
Reading,
Berkshire.



THE AIM OF this game is to score as many points as possible by landing the blocks which fly across the screen. If when landing you crash into another block you lose one go and if you do not land the block before it goes off the end of the screen you lose five points. When you have landed 35 blocks, the screen is cleared and the speed is increased.

Poke to speed up games

It uses this famous Poke to speed up the game.

POKE 65495,0

If your Dragon cannot use this, delete lines 390 and 870, and change line 950 to Goto 70. Please note if you want to use the cassette recorder you will have to reset the machine or type

POKE 65494,0

to get rid of the speed-up Poke.

```
10 HS$="THE COMPUTER":HS=50
20 GOTO 430
30 REM **THE GAME**
40 CLS0:T=3:S=0:Y=0
50 PRINT @ 4," SCORE ";
60 PRINT @ 19," CRASHES ";
70 H=RND(15)+10
80 C=RND(8)
90 PRINT @ 10,S;
100 PRINT @ 27,(3-T);
110 FOR F=0 TO 63
120 SET(F,H,C)
130 IF INKEY$<>"" THEN GOTO 210
140 FOR G=1 TO LP:NEXT
150 RESET(F,H)
```

(continued on page 189)

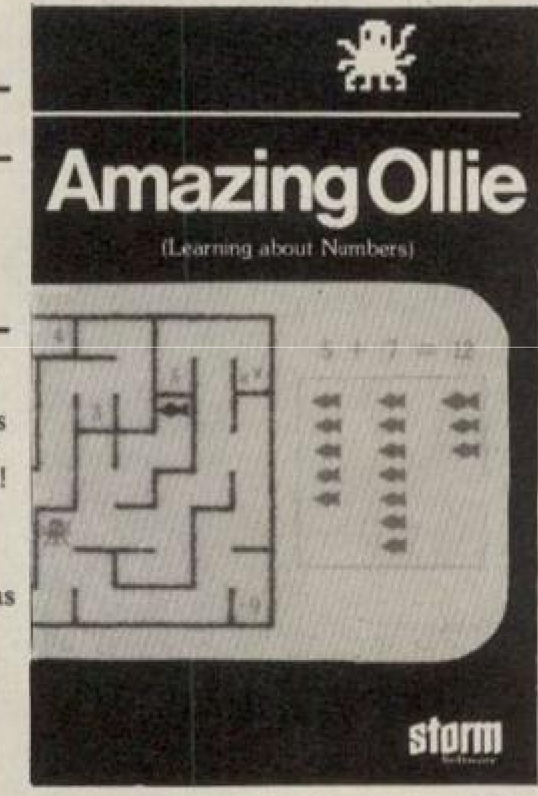
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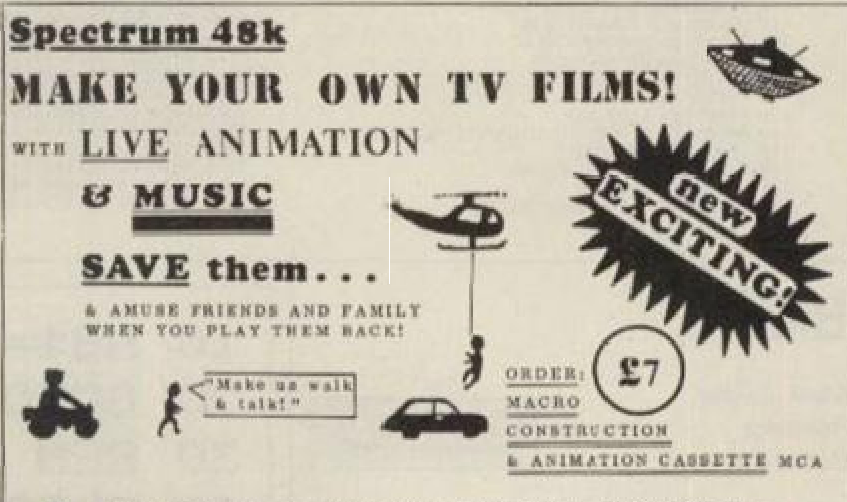
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- NO SPECIAL SKILLS OR COMPUTER KNOWLEDGE NEEDED . . . JUST IMAGINATION!



(continued from page 187)

```
160 NEXT F
170 REM **OFF THE SCREEN**
180 SOUND 10,4
190 IF S>4 THEN S=S-5
200 GOTO 70
210 REM **LANDING THE BLOCK**
220 RESET(F,H)
230 FOR G=H+1 TO 29
240 SET(F,G,C)
250 FOR P=1 TO 10:NEXT
260 RESET(F,G)
270 NEXT G
280 IF POINT(F,G+1)>0 THEN GOTO 350
290 SET(F,G+1,C)
300 PLAY"T255CDEFGAB"
310 S=S+10
320 Y=Y+1
330 IF Y=35 THEN GOTO 930
340 GOTO 70
350 REM **USED UP ALL THE TRIES**
360 SOUND 1,5
370 T=T-1:IF T>0 THEN GOTO 70
380 PRINT @ 226,"YOUR TIME IS UP PRESS ANY KEY";
390 POKE 65494,0
400 IF INKEY$="" THEN GOTO 400
410 REM **TITLES**
420 IF S>HS THEN GOSUB 600
430 CLS
440 PRINT @ 12,"BLOCKS"
450 PRINT
460 PRINT " A NEW AND EXCITING GAME FOR     THE DRAGON
 32 BY MARK SADLER"
470 PRINT
480 PRINT STRING$(32,"*")
490 PRINT " TODAY'S HIGH SCORE IS"HS
500 PRINT "   BY "HS$
510 PRINT
520 PRINT "G GAME"
530 PRINT "I INSTRUCTIONS"
540 PRINT
550 PRINT "CHOOSE"
560 IN$=INKEY$
570 IF IN$="G" THEN GOTO 850
580 IF IN$="I" THEN GOTO 770
590 GOTO 560
600 REM **A NEW HIGH SCORE**
610 CLS
620 PRINT @ 12,"HIGH SCORE"
630 PRINT
640 PRINT TAB(9);"CONGRATULATIONS"
650 PRINT
660 PRINT"   YOU HAVE SCORED TODAY'S          HIGH SCOR
E.PLEASE ENTER          YOUR NAME AND PRESS ENTER"
670 PRINT:PRINT STRING$(32,"*");
680 PRINT
690 INPUT HS$
700 IF LEN(HS$)>12 THEN PRINT "TOO LONG ":GOTO 680
710 PRINT "IS THIS CORRECT?"
720 HS=S
730 IN$=INKEY$
740 IF IN$="N" THEN 600
750 IF IN$="Y" THEN RETURN
760 GOTO 730
770 REM **INSTRUCTIONS**
780 CLS:PRINT @10,"BLOCKS"
790 PRINT
800 PRINT "ALL YOU HAVE TO DO IS TO LAND   THE FLYING
BLOCK ON THE GROUND  SAFELY. YOU MUST NOT HIT ANOTHERB
LOCK WHEN YOU LAND OR YOU LOSE A TRY (YOU START WITH 3
 TRIES). ALSO YOU MUST NOT GO OFF THE    SCREEN OR YOU
 LOSE 5 POINTS.    PRESS ANY KEY TO";
810 PRINT " LAND THE BLOCKS"
820 PRINT:PRINT "  PRESS ANY KEY TO START"
830 IF INKEY$="" THEN 830
840 REM**SELECT SPEED**
850 CLS:INPUT "HOW FAST DO YOU WANT IT ( 1-10 ,10 IS T
HE FASTEST ) ";S
860 IF S>10 OR S<1 THEN 850
870 IF S>5 THEN POKE 65495,0 ELSE POKE 65494,0
880 IF S>5 THEN S=S-5
890 S=S-1
900 LP=20-((S*5))
910 GOTO 30
920 REM**LANDED 35 BLOCKS**
930 Y=0:CLS0:IF LP>4 THEN LP=LP-5:GOTO 50
940 IF LP=0 THEN LP=20
950 POKE 65495,0:GOTO 70
```

Artist

Tom Harkness,
Voorschoten,
Holland.

ORIC

THIS PROGRAM IS A technical drawing graphics tool for designing high-resolution pictures without writing a whole program to do it. It runs on the Oric-1 48K because 36K is used for the program and various blocks of memory.

When run, a > will appear in the text window which means that the program is ready for a new instruction. When the > disappears, , you are in the middle of an instruction.

The cursor, which appears as an inverse dot, can be moved around the screen using the four cursor control keys. For fast repeat in any direction, press Return, then the direction required. Any key will halt the repeat and the co-ordinates of the cursor will be displayed in the text window. When not in repeat mode, the co-ordinates of the cursor are constantly displayed.

To make a dot appear on the screen, press D and the cursor will disappear. This is because the dot is inverse — FB number 2 — and as soon as you move the cursor, both the dot and the cursor will appear.

When the space-bar is pressed, a line will be drawn to the current position of the cursor from either the end of the previous line or from a specified origin. The line is drawn in inverse so that it can be seen against any background. To specify a new origin, press the delete key and the current position of the cursor will become the new origin.

If a fixed origin is required, all the lines are drawn to that position, then press 0 and specify the origin with Delete. Pressing 0 a second time will take you back to normal mode.

To draw a circle, specify your origin as the centre of the circle and move on an X-axis to specify the radius. Then press C followed by the FB number 0 — for background colour — and 1 — for foreground colour.

There are 10 separate programmable positions with allow quick, convenient movements of the cursor. To store the current position of the cursor, press backslash followed by one of the numbers 0 to 9. By pressing a key 0 to 9 on its own, the cursor will move to that predefined position. All positions are set to 0, 0 when run. Pressing K will allow you to enter a new X and Y position of the cursor from the keyboard.

To define a character in the alternative character set, first use Dot to form a 6 by 8 character location 0, 0 to 5, 7 at the top left-hand corner of the screen. Then press G followed by any non-control character on the keyboard. This can then be plotted anywhere else on the screen at the position of the cursor by pressing Q followed by the character and finally the FB number. To write a whole line on the screen, press W, enter the string and press Return.

To define one of 10 strings of character in the alternate character set, press control S, followed by the number of the string — 0 to 9 — and then the actual string. Return will end the string. To print the string either horizontally — 0 — or vertically — 1 — press Control P, the number of the string, the direction, and then the FB number.

To invert an x by y block of the screen — origin at the cursor — enter i followed by x,y. The width x should be given in character widths — six pixels; y is in pixels.

Pressing Control L clears the screen, while pressing Escape then £ breaks the program and returns to text mode.

You can temporarily store the screen in any of three positions in memory and load them back at any time. While dealing with screens 1, 2 and 3 refer to the three memory screens. The hexadecimal addresses are:

A000 to BFFF
1. 3000 TO 4FFF
2. 5000 TO 6FFF
3. 7000 TO 8FFF

The programmable positions are stored along with the screens so there are actually four sets of positions.

There are four commands in machine code used for handling of screens. The first is S which stores the actual screen into a memory screen 1, 2 or 3. For example, S 1 stores the actual screen in memory screen 1.

R recalls memory screens to the actual screen, where R is followed by the number of the memory screen.

X exchanges the actual screen with a given memory screen.

M merges a given memory screen with the actual screen.

Any of screens 1, 2 and 3 can be Saved on cassette and loaded back into their old screen positions later on. Press T — tape — followed by L — Load — or S — Saved. For Saving, the screen is specified but for loading, no screen is given and it will be loaded into the same

(continued on page 191)

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Shamus	Showcase	Atari/CBM64	£24.95
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Jet Pac	Ultimate	VIC-20	£5.50
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(continued from page 189)

screen as it was Saved in. For this reason it is best to write down 1, 2 or 3 next to the file name when filing your pictures.

If your tape recorder is not reliable with fast save, change the second zero in line 1030 to a 1 and the second zero in line 1060 to a 1. This will then use a slow save and load. The Save/Load routines are in machine code because of the bug in the Basic memory block load.

Command summary.

Move cursor	Cursor keys
Repeat	Return, cursor key
Keyboard entry	K, x, y co-ordinates
Dot	D
Line	Space bar
Circle	C, FB number
New origin	DEL
Recall programmable positions	0 to 9
Program positions	/, 0 to 9
Fixed origin	O (toggle action)
Define character	G, character
Recall character at current cursor position	Q, character, FB
Store screen	S, screen
Recall screen	R, screen
Exchange screen with memory screen	X, screen
Merge memory screen with screen	M, screen
Write text	W, string, return
Define string	Control — S, 0 to 9, string return
Print string	Control — P, 0 to 9, direction, FB
Inverse section of screen	I, Length, height, return
Clear screen	Control — L
Break	ESC, £

```
2 REM FOR £ READ HASH CHARACTER
4 M=£BFE0
5 FORI=0TO31:POKEM+I,0:NEXT
8 A(0)=£C000:A(1)=£5000:A(2)=£7000:A(3)=£9000
10 PAPER0:INK6:PRINTCHR$(6)
12 RESTORE:GOSUB1000'MC
20 HIRES:PRINTCHR$(17)
30 X=0:Y=0:CURSETX,Y,1:D=X:E=Y
40 PRINTX,Y:PRINT">";:GETA$:A=ASC(A$):IFA>7ANDA<12THEN
ONA-7GOSUB500
,510,520,530:GOTO40
41 PRINTCHR$(127);
42 N=FRE("")
45 IFA=32THEN200
46 IFA=12THENPING:GOTO20
47 IFA=127THEND=X:E=Y:GOTO40
48 IFA=82THEN800
49 IFA=83THEN850
50 IFA=27THEN300
51 IFA=88THEN900
52 IFA=67THEN600
53 IFA=68THENCURSETX,Y,2:GOTO40
54 IFA=87THEN750
55 IFA=13THEN100
56 IFA=84THEN2000
57 IFA=79THENO=O+1AND1:GOTO40
58 IFA=75THEN400
59 IFA=71THEN350
60 IFA=81THEN250
61 IFA=16THEN160
62 IFA=77THEN950
63 IFA=73THEN700
64 IFA=19THEN150
65 IFA<>92THEN70
67 GETA$:POKE£BFE0+VAL(A$),X:POKE£BFF0+VAL(A$),Y:GOTO4
0
70 CURSETX,Y,2:X=PEEK(£BFE0+VAL(A$)):Y=PEEK(£BFF0+VAL(
A$)):CURSETX,
Y,2:GOTO40
100 GETA$:A=ASC(A$)-7:IFA<1ORA>4THEN40
105 PRINT:PRINT
110 REPEAT:ONAGOSUB500,510,520,530:UNTILKEY$<>""ORNOTH
:GOTO40
150 GETA$:T=VAL(A$)
155 INPUTC$(T):IFLEN(C$(T))>39THENPRINT"TOO LARGE":GOT
O155
157 GOTO40
160 CURSETX,Y,2:TX=X:TY=Y
162 GETA$:T=VAL(A$)
163 GETA$:U=VAL(A$)
164 GETA$:W=VAL(A$)AND1:IFWTHENJ=0:K=8ELSEJ=6:K=0
165 FORI=1TOLEN(C$(T)):CURSETTX,TY,3:CHARASC(MID$(C$(T
),I,1)),1,U
170 TX=TX+J:TY=TY+K:IFTX>231ORTY>191THENI=LEN(C$(T))
175 NEXT
180 CURSETX,Y,2:GOTO40
200 CURSETX,Y,2
205 IFD<>XORE<>YTHENDRAWD-X,E-Y,2:CURSETX,Y,3:IFO=0THE
ND=X:E=Y
207 CURSETX,Y,2
210 GOTO40
250 IFX>232ORY>192THENPRINT:PRINT"OFF SCREEN":GETX$:GO
TO40
252 GETG$
255 GETA$:V=VAL(A$):IFV>2THEN255
257 CURSETX,Y,2
260 CHARASC(G$),1,V:CURSETX,Y,2:GOTO40
300 GETA$:IFA$="_"THENTEXT:PAPER7:INK0:PRINTCHR$(6):EN
D
306 GOTO40
350 GETG$:G=ASC(G$):IFG<32ORG>126THEN350
360 T=39936+G*8
365 CURSETX,Y,2
370 FORI=40960TO41240STEP40:POKET,PEEK(I)AND63:T=T+1:N
EXT:CURSETX,Y
,2:GOTO40
400 CURSETX,Y,2:INPUTX,Y
410 IFX<0THENX=0:GOTO430
420 IFX>239THENX=239
430 IFY<0THENY=0:GOTO450
440 IFY>199THENY=199
450 CURSETX,Y,2:GOTO40
500 CURSETX,Y,2:H=(X<>0):X=X+H:CURSETX,Y,2:RETURN
510 CURSETX,Y,2:H=(X<>239):X=X-H:CURSETX,Y,2:RETURN
520 CURSETX,Y,2:H=(Y<>199):Y=Y-H:CURSETX,Y,2:RETURN
530 CURSETX,Y,2:H=(Y<>0):Y=Y+H:CURSETX,Y,2:RETURN
600 V=ABS(X-D+(E=D)):IFD-V<0ORD+V>239ORE-V<0ORE+V>199T
HEN40
602 GETA$:N=VAL(A$)AND1
605 CURSETD,E,3:CIRCLEV,N:CURSETX,Y,3
610 GOTO40
650 CURSETX,Y,2:INPUTW$
655 FORI=1TOLEN(W$):CHARASC(MID$(W$,I,1)),0,1:X=X+7:IF
X>231THENX=X-
7:GOTO670
660 CURSETX,Y,3:NEXT
670 CURSETX,Y,2:GOTO40
700 INPUT"DIMENSIONS ?";A,B:POKE£7F,AAND255:M=40959+IN
T(X/6)+Y*40
705 IFB+Y>199THEN700
707 CURSETX,Y,2
710 FORI=1TOB:DOKE£00,M:CALL£9350:M=M+40:NEXT
715 CURSETX,Y,2
720 GOTO40
800 GETA$:T=VAL(A$):IFT>3ORT<1THEN800
805 DOKE£02,A(0):DOKE£00,A(T)
810 CURSETX,Y,2:CALL£9000:CURSETX,Y,2
815 CLS
820 GOTO40
850 GETA$:T=VAL(A$):IFT>3ORT<1THEN850
855 DOKE£00,A(0):DOKE£02,A(T)
860 CURSETX,Y,2:CALL£9000:CURSETX,Y,2
870 GOTO40
900 GETA$:T=VAL(A$):IFT>3ORT<1THEN900
905 DOKE£00,A(0):DOKE£02,A(T)
910 CURSETX,Y,2:CALL£9200:CURSETX,Y,2
915 CLS
920 GOTO40
950 GETA$:T=VAL(A$):IFT>3ORT<1THEN950
955 DOKE£00,A(T):DOKE£02,A(0)
960 CURSETX,Y,2:CALL£9100:CURSETX,Y,2
965 CLS
970 GOTO40
1000 REM LOAD MC
1005 REM SAVE
1010 FORI=0TO19
1020 READD:POKE£400+I,D:NEXT
1030 DATA£A9,£20,£85,£35,£A9,£0,£85,£36,£85,£67,£20,£C
A,£EA,£20,£7B
,£E5
1032 DATA£20,£04,£E8,£60
1035 REM LOAD
1040 FORI=0TO19
1050 READD:POKE£450+I,D:NEXT
1060 DATA£A9,£20,£85,£35,£A9,0,£85,£36,£85,£67,£20,£CA
,£EA,£20,£A0,
£E4
1070 DATA£20,£04,£E8,£60
1075 REM MC MOVE
1080 FORI=0TO36
1090 READD:POKE£9000+I,D:NEXT
1100 DATA£A5,£01,£38,£E9,£21,£85,£04,£C6,£01,£C6,£03,£
A9,0,£85,£00,
£85,£02
1110 DATA£A0,£FF,£B1,£00,£91,£02,£88,£D0,249,£C6,£01,£
C6,£03,£A5,£0
4,£C5,£01
1120 DATA£D0,239,£60
1200 REM MC 'OR'
1210 FORI=0TO42
1220 READD:POKE£9100+I,D:NEXT
1230 DATA£A5,£01,£38,£E9,£21,£85,£04,£C6,£01,£C6,£03,£
A9,0,£85,£00,
£85,£02
1240 DATA£A0,£3F,£B1,£00,£85,£7F,£B1,£02,£05,£7F,£91,£
02,£88,£D0,24
3,£C6,£01
1250 DATA£C6,£03,£A5,£04,£C5,£01,£D0,233,£60
1300 REM MC SWAP
1310 FORI=0TO44
1320 READD:POKE£9200+I,D:NEXT
1330 DATA£A5,£01,£38,£E9,£21,£85,£04,£C6,£01,£C6,£03,£
A9,0,£85,£00,
£85,£02
1340 DATA£A0,£FF,£B1,£00,£85,£7F,£B1,£02,£91,£00,£A5,£
7F,£91,£02,£8
8,£D0,241
1350 DATA£C6,£01,£C6,£03,£A5,£04,£C5,£01,£D0,231,£60
1400 REM INVERSE
1450 FORI=0TO11
1460 READD:POKE£9350+I,D:NEXT:RETURN
1470 DATA£A4,£7F,£B1,£00,£49,£80,£91,£00,£88,£D0,247,£
60
2000 REM TAPE
2010 PRINT:PRINT"S - SAVE      L - LOAD"
2020 GETY$:IFY$="S"THEN2100
2030 IFY$="L"THEN2200ELSEGOTO2020
2100 PRINT:PRINT"SCREEN - 1,2 OR 3 ?"
2101 GETY$:T=VAL(Y$):IFT>3ORT<1THEN2101
2105 SA=A(T)-8192:EA=A(T)-1
2110 PRINT:PRINT"PRESS RECORD ON TAPE THEN PRESS A KEY
"
2115 GETY$:DOKE£5F,SA:DOKE£61,EA
2120 CALL£400:PRINT:PRINT"READY":GETY$:GOTO40
2200 REM
2210 PRINT:PRINT"PRESS PLAY ON TAPE":CALL£450:PRINT:PR
INT"READY":GE
TY$
2220 L=0:P=0
2230 GOTO40
```

Fly catcher

Colin Peacock,
Braunton,
North Devon.



FLY CATCHER IS an original, short program which will run on the unexpanded Vic-20. You are a spider and the aim is to spin a web all over the screen to stop the fly reaching the left-hand wall before it eats its way through.

Unfortunately the fly eats more and more web as time goes by, and it also gets faster. As though that is not enough, there is a Demon Web Muncher who, every so often, eats random parts of your web.

The spider can be moved with the keys: 1-Down, 2-Up, 9-Left, 0-Right or it can be moved with the joystick. When the fly reaches the far wall, the computer plays a Death March and tells you your time. If it is a new best time then it will ask you to type in your initials, and whether you would like another go.

Program notes.

1 to 200	Sets up graphics, prints instructions and plays tune, POKE 808,127 in line 5 disables Run/Stop Restore, and can be left out
200 to 500	Main Program Loop
221 to 255	Joystick/keyboard input
550 to 580	Movement subroutines
850 to 1000	Game end, SYS64824 in line 956 clears program so can be ommited
1000 to 1040	Instructions
1100 to 1140	Demon Web Muncher subroutine
2000 to 2040	Hi-res characters
3000 to 3100	Music data

```
1 REM**FLY  CATCHER**
2 REM*COLIN  PEACOCK*
3 REM******1983******
5 POKE808,127:POKE52,28:POKE56,28:CLR:CL=30720:HI$="000000"
10 RESTORE:GOSUB1000:GOSUB2000:N1=0:V=0:Z=0:S1=36876:S2=36875:D4=1:GOSUB3000:U=
7725
20 V=3:G=0:PRINT"▮       IIT ♠  ʼEY";
32 GETA$
34 IF(PEEK(37151)AND32)=0ORA$<>""THEN100
35 GOTO32
100 POKE36869,255
110 POKE36879,12:PRINT"♫":FORI=7702TO7723:POKEI,0:NEXT:FORI=8164TO8185:POKEI,0:
NEXT
120 FORI=7724TO8142STEP22:POKEI,1:NEXT:FORI=7745TO8163STEP22:POKEI,0:NEXT
195 TI$="000000"
200 PRINT"▮▮TIME "LEFT$(TI$,2);":";MID$(TI$,3,2);"′";RIGHT$(TI$,2)
210 POKEU,2:POKEU+CL,3
220 IFN1/D4<>INT(N1/D4)THEN260
221 PA=37151:POKEPA,0:PB=37152:RB=37154
222 W=PEEK(PA):POKERB,127:E1=PEEK(PB):POKERB,255
225 IF((WAND4)=0ORPEEK(197)=56)ANDPEEK(U-22)<>0THENGOSUB550
235 IF((WAND8)=0ORPEEK(197)=0)ANDPEEK(U+22)<>0THENGOSUB560
245 IF((WAND16)=0ORPEEK(197)=4)ANDPEEK(U-1)<>1THENGOSUB570
255 IF((E1AND128)=0ORPEEK(197)=60)ANDPEEK(U+1)<>0THENGOSUB580
260 FORA=1TO5:NEXT:POKES1,0:POKES2,0
270 IFZ=0THENGOSUB800
310 POKES,3
315 IFPEEK(S-1)=4THENSP=SP-1:IFSP=0THENPOKES,6:POKES-1,6:Z=0:GOSUB800
320 IFZ/V+3=INT(Z/V+3)THENPOKES,9:S=S-1:POKES2,156
```

(continued on page 193)

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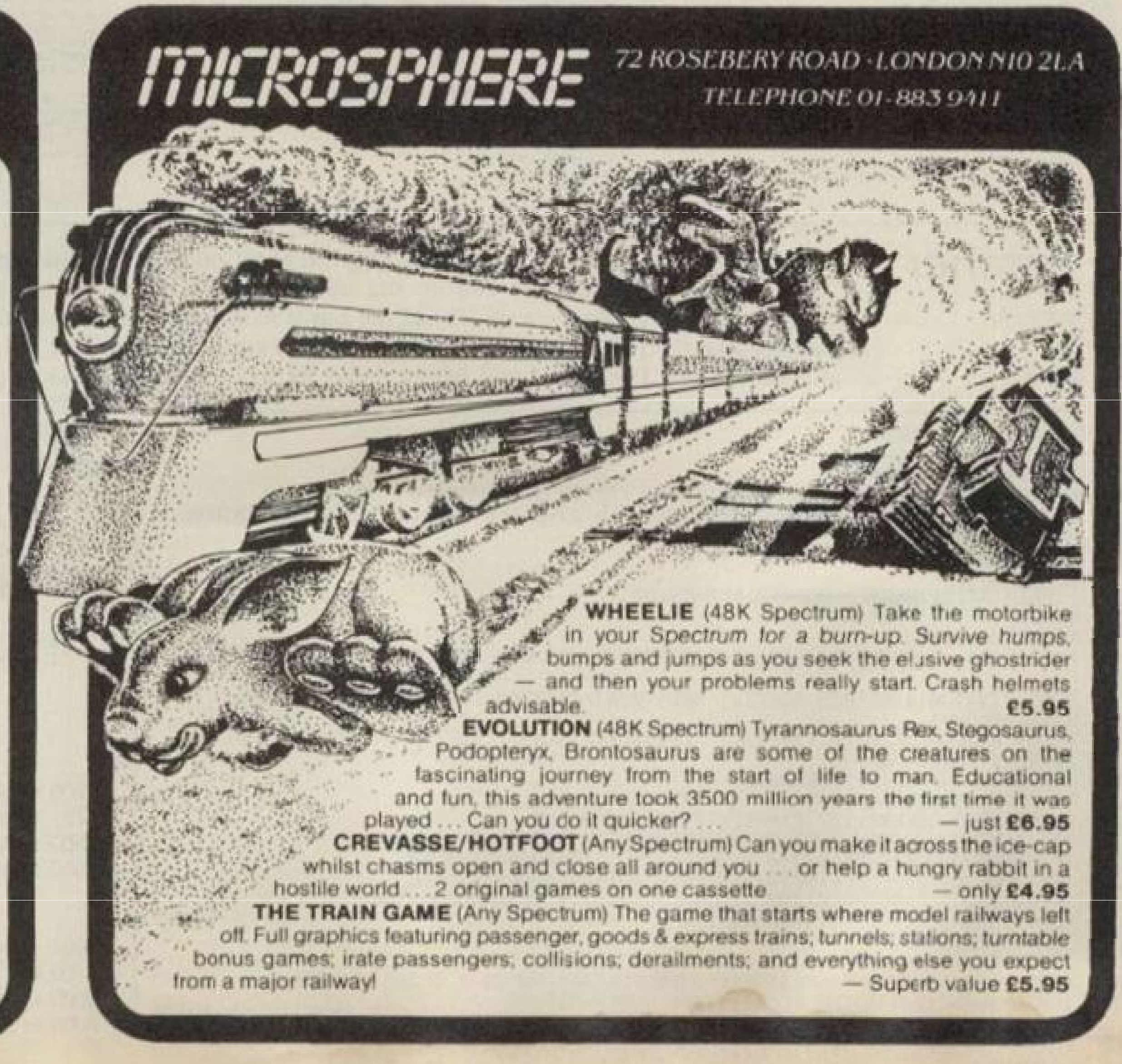


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Zombies

*D Green,
Ashford,
kent.*



ZOMBIES FOR THE 16K ZX-81 is a machine-code version of the popular game which involves escaping from things which want to kill you. The only way to destroy these robots, zombies, or whatever you think the ZX-81 graphics look like, is to lure them into various pitfall traps, which you are able to jump over. Since the game is completely written in machine code, rather than Basic, it is extremely fast and becomes even more difficult as the game goes on. You score 100 points for each robot that falls into a hole, and move using the usual cursor keys.

To load the machine code, first type in a Rem statement at least 720 characters long. The easiest way to do this is to type in four separate Rems each with 192 characters — six full lines — numbered 1, 2, 3, 4 and then to enter as direct commands:

```
POKE 16511,20
POKE 16512,3
```

This will then produce a line 786 characters long, which gives you enough room to put in any of your own routines if you want to. Another useful command is Poke 16510,0 which will prevent you from accidentally erasing the first line. Notice that when you List the program, although lines 2, 3, and 4 appear to be separate they are in fact joined together as trying to Edit them will prove. Next you will have to type in the machine code. Any hex loader may be used for this although you must make sure that it starts at address 16570, as the first 56 bytes of the Rem statement are used for data. For example, you could use the one on page 83 of this issue.

Enter the machine code in listing 1 as normal, Save the program a few times and then — the moment of truth — enter Rand USR 16599. A screen full of robots should appear and start moving purposefully towards the X in the middle, which is you. After three explosions the game should then stop with the report code 0/0. If it does not work properly then you can either check the machine code using the table below, or switch the computer off and check it later when you feel less frustrated. If the program does work then enter the Basic program in listing 2 which displays the instructions. Save it, and then enjoy the game.

In case you have made a mistake in typing in the code, this table should help you find where the error is. For example, if the program crashes at the end of a wave then you only need to check the addresses between 17043 and 17164.

Name	Start address	Function
1. Print At	16570	Subroutine to convert x,y co-ordinates into a screen location.
2. Set	16599	Sets various variables.
3. Print	16641	Draws border, prints holes and robots.
4. Player Move	16782	Moves player, checks if hit wall or robot.
5. Zomset	16851	Sets data pointers for Zommove.
6. Zommove	16868	Moves robots, checks if hit man or hole.
7. Check	16951	Checks if all robots are dead.
8. Delay	167977	Delay loop to control speed.
9. Kill	16989	Hi-res explosion, subtracts a life.
10. Wave	17043	Prints message, more robots, faster speed etc.
11. Score	17164	Adds 100 to score.
12. Words1	17229	"Wave complete Bonus: 500" data.
13. Words2	17229	"Score: 0000000 Lives: 3" data.

(continued from page 191)

```
330 Z=Z+1:IFPEEK(S)=1THENT=TI:GOTO850
340 IFN1/200=INT(N1/200)THENV=V-1
345 IFV=0THEND4=D4+1:V=3
350 IFINT(RND(1)*100)+1=50THENGOSUB1100
500 N1=N1+1:GOTO200
550 POKEU,4:U=U-22:POKES1,200:RETURN
560 POKEU,4:U=U+22:POKES1,210:RETURN
570 POKEU,4:U=U-1:POKES1,220:RETURN
580 POKEU,4:U=U+1:POKES1,230:RETURN
800 S=7744+22*INT(RND(0)*20)
840 Y=Y+1:SP=Y:RETURN
850 C$=TI$
855 FORI=1TO10:READA,B:POKES2,195+A:FORJ=1TOB:NEXT:POKES2,0:FORJ=1TO5:NEXT:NEXT
900 POKE36869,242:IFVAL(C$)>VAL(HI$)THENHI$=C$:GOTO960
910 PRINT"⌐HE  SPIDER  GOT  YOU,HARD CHEESE"
915 PRINT"YOUR TIME... "LEFT$(C$,2)":"MID$(C$,3,2)"′"RIGHT$(C$,2)
920 PRINT"|EST TIME... ";LEFT$(HI$,2)":"MID$(HI$,3,2)"′"RIGHT$(HI$,2):PRINT"BY.
.. ";N$
950 PRINT"▒▒NOTHER GO? (Y/N)"
955 GETA$:IFA$=""THEN955
956 IFA$="N"THENSYS64824
957 IFA$="Y"THEN10
958 GOTO955
960 PRINT"⌐REAT  ⁄EW  |EST |IME-"LEFT$(C$,2);":";MID$(C$,3,2),"′",RIGHT$(C$,2)
970 PRINT"¬NTER TWO INITIALS"
975 FORI=1TO10:GETA$:NEXT
980 GETA$:IFA$=""THEN980
985 PRINTA$;".";
990 GETB$:IFB$=""THEN990
992 PRINTB$;"."
995 N$=A$+"."+B$+"."
996 GOTO950
1000 POKE36869,242:POKE36879,218
1005 PRINT"⌐▒                              ▒-L ▒  ▒-▒|-Г-▒
  "
1010 PRINT"  ▒TOP THE FLY GETTING▒PAST YOUR SPIDERS WEB."
1015 PRINT"  ⁄SE THESE KEYS:-    ▒,P-2, ¬OWN-1,  LEFT-9,▒-IGHT-0,ГR 'OYSTICK."
1030 PRINT"▒  |HE GAME GETS HARDER▒AS TIME GOES ON."
1035 PRINT"▒  OATCH  OUT  FOR  THE▒′¬EMON OEB \UNCHER′"
1040 RETURN
1100 PRINT"▒▒IT'S THE WEB MUNCHER":POKE36877,160
1105 FORI=1TO120STEP4
1107 POKE36876,130+I
1110 RN=INT(RND(1)*436)+7725
1120 IFPEEK(RN)=0ORPEEK(RN)=1ORPEEK(RN)=2ORPEEK(RN)=3THEN1110
1130 POKERN,5:FORA=1TO10:NEXT:NEXT
1135 PRINT"▒                              "
1140 POKE36877,0:POKE36876,0:RETURN
2000 FORA=7168TO7679:POKEA,0:NEXT
2010 FORA=7168TO7207:READB:POKEA,B:NEXT:RETURN
2020 DATA255,255,255,255,255,255,255,255,254,253,254,253,254,253,254,253
2030 DATA129,66,126,90,255,90,126,66
2040 DATA12,30,158,127,127,158,30,12,8,16,32,16,8,4,2,4
3000 POKE36878,15
3010 READA:IFA=-1THENPOKES1,0:POKES2,0:RETURN
3020 FORC=1TO2:POKES1,A+200:POKES2,A+200:FORB=1TO30:NEXT:POKES2,0:FORB=1TO30:NE
XT
3025 NEXT:GOTO3010
3030 DATA-5,7,15,19,21,19,15,7,-5,7,15,19,21,19,15,7,9,19,25,28
3040 DATA29,28,25,19,-5,7,15,19,21,19,15,7,15,23,28,31,32,31-28,23
3050 DATA9,19,25,28,29,28,25,19,-5,7,15,19,21,19,15,7,-5,-1
3100 DATA0,800,0,600,0,200,0,600,8,800,6,200,6,600,0,600,-4,200,0,800
```

Listing 1.

```
16570 - C5D5F52A0C402311 = 825
16578 - 2100788728031910 = 420
16586 - FD79B72804412310 = 717
16594 - FDF1D1C1C9AF3284 = 1454
16602 - 40210F0A2282403E = 412
16610 - 323285403E0A3287 = 554
16618 - 403E1E3288400100 = 405
16626 - 15CDBA4011374 31A = 641
16634 - 772313FE1F20F801 = 739
16642 - 0000CDBA4036800C = 649
16650 - 79FE2020F5161304 = 729
16658 - 0E00CDBA4036800E = 665
16666 - 1FCDBA4036801520 = 721
16674 - EE010014CDBA4036 = 768
16682 - 800C79FE2020F53A = 882
16690 - 8640473A35405F3A = 597
16698 - 3440E60F57C5131A = 690
16706 - E61F3CFE1F30F74F = 980
16714 - 131AE61F3CFE1430 = 688
16722 - F747CDBA407EB720 = 1114
16730 - E53634C110DF2188 = 936
16738 - 403A8740 47C5E513 = 837
16746 - 1AE61F3CFE1F30F7 = 927
16754 - 4F131AE61F3CFE14 = 719
16762 - 30F747CDBA407EB7 = 1130
16770 - 20E53626E1712370 = 636
16778 - 23C1100 9ED4B8240 = 967
16786 - 3A8440CDBA40773E = 890
16794 - F7DBFECB67200 10D = 1072
16802 - 3EEFDBFECB572001 = 1097
16810 - 0CCB67200104CB5F = 653
16818 - 200105CDBA407EFE = 873
16826 - 802008ED4B8240CD = 879
16834 - BA407EFE26CA5D42 = 1029
16842 - 328440383DED4382 = 795
16850 - 403A874047218840 = 625
16858 - 3A35405F3A3440E6 = 674
16866 - 0F57C5E54E79FE80 = 1109
16874 - 2841234 8CDBA4036 = 719
16882 - 00131AE601200E3A = 380
16890 - 8240B92814300 30D = 503
16898 - 18010C180C3A8340 = 326
16906 - B8280630030 51801 = 311
16914 - 04CDBA407EFE3420 = 923
16922 - 070E80CD0C43180B = 468
16930 - FE3D2008C1C1C35D = 1026
16938 - 423626E171237023 = 678
16946 - C105C2E441218840 = 918
```

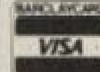
(continued on page 195)

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DPOKE	— double POKE.
EDIT	— a specified line number.
ELSE	— used with IF. . .THEN.
GET	— waits for keyboard entry; doesn't use ENTER.
KEYWORDS	— shifts between new keywords and normal graphics mode.
ON	— GOSUB or GO TO a line number from a list of line numbers.
ON ERROR	— allows trapping of most reports; has available ERROR, LINE and STAT variables.
POP	— removes data from BASIC's stack.
PROC	— named procedures, with DEF PROC and END PROC.
RENUM	— renumber part or whole program with specified start line and increment. Handles GO TO, GOSUB, ON, etc.
ROLL	— pixel movement of part or whole screen in any direction, with wrap-round.
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(continued from page 193)

```
16954 - 16003A6740477E23 = 511
16962 - 23FE80200111410F5 = 731
16970 - 3A67408ACA93423A = 916
16978 - 85406728 7CB520FB = 931
16986 - C38E4101003236BD = 696
16994 - 0B78363DB120F706 = 708
17002 - 2078ED471100031B = 507
17010 - 7A8320FB10F33E1F = 936
17018 - ED473600011515CD = 610
17026 - BA407E3D77FE1CC8 = 1038
17034 - 210F0A228240C38E = 623
17042 - 413A87403CFE1A20 = 694
17050 - 013D3287403A8640 = 567
17058 - 3DFE0920013C3286 = 601
17066 - 403A8540D605FE05 = 797
17074 - 2002C60532854011 = 501
17082 - 2143010A0ACDBA40 = 576
17090 - 060D1A77231310FA = 484
17098 - 010C0CCDBA400609 = 495
17106 - 1A77231310FA0605 = 476
17114 - CD0C4310FB011515 = 594
17122 - CDBA407E3CFE2620 = 965
17130 - 013D770100000878 = 313
17138 - B120FB06130E1ECD = 734
17146 - BA4036000D20F810 = 513
17154 - F4210F0A228240C3 = 725
17162 - 0141C5010A15CDBA = 586
17170 - 40C17E3CFE262005 = 772
17178 - 361C2B18F577C9BC = 902
17186 - A6BBAA80A6B4B2B5 = 1358
17194 - B1AAB9AAA7B4B3BA = 1414
17202 - B88EA19C9C382834 = 947
17210 - 372A0E1C1C1C1C1C = 251
17218 - 1C1C0000312E382A = 252
17226 - 380E1F1C1C1C1C1C = 241
```

Listing 2.

```
  1 POKE 16418,0
 10 PRINT TAB 9;"ZOMBIES";TAB 9
;"        ";TAB 7;"(C)D.GREEN"
 20 LET A$=""
 30 PRINT
 40 PRINT "YOU ARE SURROUNDED B
Y SEVERAL   DANGEROUS ROBOTS WHI
CH HAVE BEENPROGRAMMED TO HUNT Y
OU DOWN AND TO DESTROY YOU,NO MA
TTER WHAT ISIN THEIR WAY."
 50 PRINT ,,"FORTUNATELY THERE
ARE A FEW      HOLES AROUND WHICH
 YOU CAN LURE THE ROBOTS INTO,BU
T WHICH YOU    ARE ABLE TO JUMP O
VER."
 60 PRINT ,,"BE VERY CAREFUL NO
T TO TOUCH ANYOF THE ROBOTS AS T
HEY WILL GIVE YOL A FATAL ELECTR
IC SHOCK.",,,"BONUS LIFE FOR EVE
RY WAVE KILLED"
 70 PRINT ,,"USE ARROW KEYS TO
MOVE(HOLD DOWN2 KEYS TO MOVE DIA
GONALLY)."
 80 FOR N=16514 TO 16569
 90 POKE N,0
100 NEXT N
110 IF INKEY$="" THEN GOTO 110
120 CLS
130 LET Z=USR 16599
140 PRINT AT 10,10;"GAME OVER"
150 RUN 80
160 SAVE "ZOMBIES"
170 RUN
```

Fast lander

D L Drummond,
Abingdon,
Oxfordshire.



THIS GAME IS based on the idea from Garry Owen's Saturn Lander — *Your Computer*, May 1983. It is written for the 16K Spectrum and has not been tested on a 48K machine although I hope that it will work on one.

The aim of the implementation is to achieve a smoother and faster movement by increasing the display refresh rate. A refresh rate of 16 frames per second is achieved; a slight flicker is still discernible at this rate.

A set of sprite routines was used to move the lander and to check for collisions. These were called from the main machine-code routine which also scrolls the lines of "Asteroids" and checks for x or y out of range. The main routine returns a code to indicate success, x out of range, y out of range or a collision.

Rather than make repeated tests of the return code, it is used as a vector in a computed Goto which jumps to the appropriate error routine.

A similar vectoring technique was used to read the keyboard. The system variable last-key at address 23560 contains the ASCII code of the last key to be pressed. The subroutine to handle a given key is given a line number equal to the code for the key plus 100 so that

GOSUB 100 + PEEK(23560)

calls the appropriate subroutine.

This is only practical because Sinclair Basic does not insist that the line specified in a Goto or Gosub exists but instead will use the lowest line greater than the given number. If it were not for this feature, a subroutine would be required for each of the 256 key codes. The program should be typed in and Saved with

SAVE "lander" LINE 800

Naturally it is advisable to do this before running it in case there is an error in the machine code. The lander has three levels of thrust, selected by keys 1 to 3. A thrust of 2 is just enough to balance gravity while 1 will give a downwards acceleration and 3 will give an upwards acceleration. 8 and 0 tilt the lander left and right, 9 will return it to upright.

You must land very gently to avoid a crash but the lander will bounce unharmed from the top or sides of the screen. If you find the game too easy, try breaking in and entering:

GOTO 3000
CONTINUE

```
   5 GO SUB 400
  10 GO SUB 100+PEEK 23560
  20 LET sx=sx+ax: LET sy=sy+ay: LET x=x+sx: LET y=y+s
y
  24 POKE 32300,x: POKE 32301,192-y: GO TO USR 32308
 147 RETURN
 148 LET ax=q: POKE 32302,96: RETURN
 149 LET ay=-q: RETURN
 150 LET ay=0: RETURN
 151 LET ay=q: RETURN
 155 RETURN
 156 LET ax=-q: POKE 32302,104: RETURN
 157 LET ax=0: POKE 32302,88: RETURN
 356 RETURN
 400 CLS : LET q=.05: RESTORE 420: PLOT 0,4: FOR x=0 T
O 247 STEP 8: READ y: DRAW 8,y: NEXT x: DRAW 7,-4: POK
E 32304,0: POKE 32305,0: POKE 32302,88
 410 LET a$="                          ": FOR i=6 TO 15 STEP 3
: PRINT AT i,0;a$(i+1 TO );a$( TO i): NEXT i
 412 PLOT 103,3: DRAW 10,0
 414 RANDOMIZE : LET x=32+200*RND: LET y=192-10*RND: L
ET sx=-.5*RND: LET sy=0: LET ax=sy: LET ay=sy
 416 DEF FN t(a)=PEEK (a)+256*PEEK (a+1)+65576*PEEK (a
+2): LET t0=FN t(23672)
 418 RETURN
 420 DATA 3,4,-1,-2,-3,-2,1,4,3,-1,1,-3,-4,0,2,-2,2,3,
2,4,-2,1,-3,-4,-2,2,3,2,1,-1,-4,-3
 800 CLEAR 31999: POKE 23675,88: POKE 23676,127: BORDE
R 1: INK 7: PAPER 0: CLS : GO SUB 2000: RESTORE 1500:
PRINT : PRINT "poking data"
 810 READ a,a$: PRINT a: IF a=0 THEN GO TO 850
 820 FOR i=1 TO LEN a$-1 STEP 2: POKE a+(i-1)/2,16*(CO
DE a$(i)-48-7*(CODE a$(i)>57))+CODE a$(i+1)-48-7*(CODE
 a$(i+1)>57): NEXT i: GO TO 810
 850 PRINT "Press any key to start"
 860 IF INKEY$="" THEN GO TO 860
 870 CLS : BORDER 1: GO TO 5
1000 PRINT AT 0,0;
1030 IF (sy*sy+sx*sx)>.05 OR y>40 THEN POKE 32302,112:
 RANDOMIZE USR 32308: RANDOMIZE USR 32393: PRINT "cras
hed": LET score=200-INT (y): GO TO 1050
1034 IF (x>106 OR x<103) THEN PRINT "missed": FOR i=1
TO 4: FOR j=20 TO 12 STEP -2: BEEP .01,j: NEXT j: NEXT
 i: PLOT 107,4: DRAW 0,24: PRINT AT 17,2;"This is wher
e you should land";AT 1,0: LET score=400-INT (ABS (x-1
04.5)): GO TO 1050
1038 BEEP .2,20: BEEP .3,10: LET t0=INT ((FN t(23672)-
t0)/50): PRINT "down OK in ";t0;" seconds": LET score=
INT (400+2000/t0): GO TO 1050
1050 PRINT "score=";score: GO TO 850
1100 IF y<8 THEN LET y=8
1110 IF y>191 THEN LET y=191
1120 LET sy=-sy: GO TO 24
1200 IF x<0 THEN LET x=0
```

(continued on page 197)

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- Educational Computing, Nov 83

Colossal Adventure is included in Practical Computing's Top 10 games choice: "Poetic, moving and tough as hell."

-PC, Dec 83

"To sum up, Adventure Quest is a wonderful program, fast, exciting and challenging. If you like adventures then this one is for you"

-NILUG # 1.3

"Colossal Adventure .. For once here's a program that lives up to its name .. a masterful feat. Thoroughly recommended"

- Computer Choice, Dec 83

"wholly admirable"

- Your Computer, Sept 83

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LEVEL 9 COMPUTING

Dept Y, 229 Hughenden Road, High Wycombe, Bucks HP13 5PG

Please describe your Computer

(continued from page 195)

```
1210 IF x>247 THEN LET x=247
1220 LET sx=-sx: GO TO 24
1500 DATA 32302,"587FA0A0587F2A307EED5B327ECD3D7F2A2C7
E014C047CD6B8D001B0047DD6F8D022307EED5B2E7EED53327ED5C
DCC7ED1010A002B0301E803C5D5E521C040CDB07E218048CDB07E2
12048CD9C7E21E048CD9C7EE1D1CD267FC1C9"
1510 DATA 32393,"0E0021C47E060010FE7ED3FE230D20F5C9"
1520 DATA 32412,"1120000E087E191706202BCB1610FB240D20F
2C9"
1530 DATA 32432,"7DF61F5F0E080620541A1FCB1E2310FB7DD62
06F240D20EEC9"
1540 DATA 32460,"E5CDE67E0E08C5CD0A7FA620047923A62BC12
0030D20EFE1C9"
1550 DATA 32486,"D555CB3DCB3DCB3D7C4F0F0F0FE618477CE60
7B0C64067798787E6E0856F7AE60747D1C9"
1560 DATA 32522,"243E07A4200A7DC6206F38047CC6F867AF4FB
01A13C81FCB1910FBC9"
1570 DATA 32550,"E5CDE67E0E08C5CD0A7FB677237EB1772BC10
D20F1E1C9"
1580 DATA 32573,"E5CDE67E0E08C5CD0A7FEEFFA6772379EEFFA
6772BC10D20EDE1C9"
1590 DATA 32600,"003C7E7E3C3C42C31C3E7E7E3E44C203387C7
E7E7C2243C024815A3C3C5A8124010F1F3F3F3F1F07F0F8FCFCFCF
8F830187C7C3C0961F060001CFFFFFFFEFC0C0000C0F870000303"
1600 DATA 0," "
2000 PRINT "1 low thrust: accelerate down"
2010 PRINT "2 this just balances gravity"
2020 PRINT "3 high thrust: accelerate upward"
2030 PRINT "8 tilt left"
2040 PRINT "9 return to upright"
2050 PRINT "0 tilt right"
2060 RETURN
3000 POKE 32442,0: POKE 32443,237: POKE 32444,103: POK
E 32419,0: POKE 32423,237: POKE 32424,111
```

Keyboard Audio-Visual

Nalim Sharma,
London E17.

CBM-64

KEYBOARD Audio-Visual is designed to improve your typing and keyboard co-ordination.

The bulk of the program is written in machine code and because so little Basic is involved users can adapt the program to suit their needs.

On running, you will be confronted with a menu containing two options. The first familarises you with the keyboard and the second prints out sentences to be typed in. You can construct your own sentences simply by altering the data statements in the program. Also, pressing Return will take you back to the menu from both options.

```
10 POKE53280,3:POKE53281,1
20 POKE54272,0:POKE54273,0:PRINT"PLEASE WAIT WHILE THE M/C IS READ IN..."
30 GOSUB2000:SYS49168
100 PRINT"        KEYBOARD AUDIO VISUAL"
110 PRINT"        (C) NALIN SHARMA 1983"
120 PRINT"        PLEASE CHOOSE OPTION"
130 PRINT"          1 = PRACTICE"
140 PRINT"          2 = TYPING"
150 POKE198,0
160 GETQ$:IFQ$=""THEN160
170 Q=VAL(Q$):IFQ<1ORQ>2THEN160
180 ONQGOSUB500,1000
190 RUN20
495 REM**** PRACTICE ****
500 GOSUB5000
502 PRINT"          F1 = SCREEN COLOUR"
503 PRINT"          F3 = BORDER COLOUR"
504 PRINT"          F5 = TEXT COLOUR"
505 PRINT"          F7 = BOX COLOUR"
510 POKE49156,1
520 GETA$:IFA$<>CHR$(13)THEN520
530 POKE49156,0:RETURN
1000 GOSUB5000
1010 POKE49156,1
1020 READU$:IFU$="Z"THEN1110
1030 PRINT"            "U$"  ":TI$="000000"
1040 POKE204,0:FORW=1TOLEN(U$)
1050 POKE207,0:GETL$:IFL$=CHR$(13)THEN1110
1055 IFL$<>MID$(U$,W,1)THEN1050
1060 PRINTL$;:NEXT:POKE204,1
1070 PRINT:PRINT"      THAT TOOK YOU "TI$" SECONDS"
1100 PRINT"      HIT  FOR THE NEXT SENTENCE"
1105 GETD$:IFD$<>"+"THEN1105
1107 GOTO1000
1110 W=256:POKE204,1:POKE49156,0:RETURN
1995 REM ***** DATA LOADER *****
2000 READLN:IF(LN=-1)THEN2070
2010 READND:CH=0
2020 FORI=1TOND
2030 READDI:CH=CH+DI
2040 NEXTI
2050 READTC:IF(TC<>CH)THENPRINT"ERROR IN LINE ";LN:STOP
2060 GOTO2000
2070 RESTORE
2080 READLN,ND,SA,FA,CH
2090 AD=SA:IF(ND<>2)THENPRINT"ERROR IN ADDRESS HEADER":STOP
2100 READLN:IF(LN=-1)THEN2170
2110 READND
2120 FORI=1TOND
2130 READDI:POKEAD,DI:AD=AD+1
2140 NEXTI
2150 READCH:GOTO2100
2160 IF(AD<>(FA+1))THENPRINT"ERROR IN NUMBER OF DATA ITEMS";AD,FA:STOP
2170 RETURN
4995 REM**** PRINT KEYBOARD DISPLAY ****
5000 PRINT"           KEYBOARD AUDIO VISUAL"
5010 PRINT"   + 1 2 3 4 5 6 7 8 9 0 + - \      1":PRINT
5020 PRINT"     Q W E R T Y U I O P @ * ↑      3":PRINT
5030 PRINT"      A S D F G H J K L : ; =       5":PRINT
5040 PRINT"       Z X C V B N M , . /          7":PRINT
5050 PRINT"                   ":RETURN
20000 DATA 20000,2, 49168, 49654, 98822
20010 DATA 20010, 10 ,169,42,141,5,192,169,4,141,6,192, 1061
20020 DATA 20020, 10 ,169,0,141,4,212,169,0,141,3,212, 1059
20030 DATA 20030, 10 ,169,0,141,5,212,169,245,141,6,212, 1300
20040 DATA 20040, 10 ,169,15,141,24,212,169,200,141,1,192, 1264
20050 DATA 20050, 10 ,169,13,141,3,192,169,0,141,4,192, 1024
20060 DATA 20060, 10 ,120,169,79,141,20,3,169,192,141,21, 1055
20070 DATA 20070, 10 ,3,88,96,72,138,72,152,72,173,4, 870
20080 DATA 20080, 10 ,192,201,1,240,3,76,234,192,165,197, 1501
20090 DATA 20090, 10 ,141,0,192,205,1,192,240,72,141,1, 1185
20100 DATA 20100, 10 ,192,169,64,141,4,212,169,0,141,2, 1094
20110 DATA 20110, 10 ,192,162,32,173,5,192,133,251,173,6, 1319
20120 DATA 20120, 10 ,192,133,252,32,25,193,173,0,192,10, 1202
20130 DATA 20130, 10 ,170,189,116,193,133,251,141,5,192,189, 1579
20140 DATA 20140, 10 ,117,193,133,252,141,6,192,201,0,240, 1475
20150 DATA 20150, 10 ,77,162,160,32,25,193,173,0,192,24, 1038
20160 DATA 20160, 10 ,105,50,141,1,212,169,65,141,4,212, 1100
20170 DATA 20170, 10 ,238,2,192,173,2,192,201,15,208,48, 1271
20180 DATA 20180, 10 ,169,1,141,2,192,173,0,192,201,4, 1075
20190 DATA 20190, 10 ,208,6,238,33,208,76,234,192,201,5, 1401
20200 DATA 20200, 10 ,208,6,238,32,208,76,234,192,201,6, 1401
20210 DATA 20210, 10 ,208,9,238,134,2,32,242,192,76,234, 1367
20220 DATA 20220, 10 ,192,201,3,208,3,238,3,192,104,168, 1312
20230 DATA 20230, 10 ,104,170,104,76,49,234,169,0,133,253, 1292
20240 DATA 20240, 10 ,169,216,133,254,160,0,173,134,2,145, 1386
20250 DATA 20250, 10 ,253,165,253,24,105,1,133,253,165,254, 1606
20260 DATA 20260, 10 ,105,0,133,254,201,219,208,234,165,253, 1772
20270 DATA 20270, 10 ,201,232,208,220,96,165,251,133,253,165, 1932
20280 DATA 20280, 10 ,252,24,105,212,133,254,160,0,192,3, 1335
20290 DATA 20290, 10 ,240,12,138,145,251,173,3,192,145,253, 1552
20300 DATA 20300, 10 ,200,76,38,193,32,95,193,160,0,138, 1125
20310 DATA 20310, 10 ,145,251,173,3,192,145,253,200,200,192, 1754
20320 DATA 20320, 10 ,4,208,242,32,95,193,160,0,192,3, 1129
20330 DATA 20330, 10 ,240,12,138,145,251,173,3,192,145,253, 1552
20340 DATA 20340, 10 ,200,76,78,193,96,165,251,24,105,40, 1228
20350 DATA 20350, 10 ,133,251,133,253,165,252,105,0,133,252, 1677
20360 DATA 20360, 10 ,24,105,212,133,254,96,72,4,231,4, 1135
20370 DATA 20370, 10 ,56,5,59,5,75,4,155,4,235,4, 602
20380 DATA 20380, 10 ,54,5,48,4,127,4,206,4,50,4, 506
20390 DATA 20390, 10 ,31,5,208,4,129,4,0,0,52,4, 437
20400 DATA 20400, 10 ,131,4,210,4,54,4,35,5,212,4, 663
20410 DATA 20410, 10 ,133,4,33,5,56,4,135,4,214,4, 592
20420 DATA 20420, 10 ,58,4,39,5,216,4,137,4,37,5, 509
20430 DATA 20430, 10 ,60,4,139,4,218,4,62,4,43,5, 543
20440 DATA 20443, 10 ,220,4,141,4,41,5,64,4,143,4, 630
20450 DATA 20450, 10 ,222,4,66,4,47,5,224,4,145,4, 725
20460 DATA 20462, 10 ,45,5,68,4,147,4,226,4,70,4, 577
20470 DATA 20470, 10 ,0,0,220,4,149,4,49,5,44,4, 487
20480 DATA 20480, 10 ,42,4,0,0,46,4,119,5,0,0, 220
20490 DATA 20490, 6 ,125,4,0,0,0,0, 129 ,-1
30000 DATATHE QUICK BROWN FOX JUMPED OVER THE LAZY DOG
30010 DATATHIS PROGRAM IS CALLED KEYBOARD AUDIO VISUAL
30020 DATATHE PURPOSE OF THIS PROGRAM IS TO IMPROVE KEYBOARD COORDINATION
30030 DATAHOPEFULLY K.A.V. WILL BE AN AID TO TWO FINGER TYPISTS
30040 DATAWHY IS THE COMMODORE DISK DRIVE SO SLOW?
30050 DATAMY PRINTER HAS RECENTLY RECEIVED A REAL HAMMERING
30060 DATAUSE YOUR OWN SENTENCES BECAUSE YOU MIGHT FIND MINE UNINTERESTING
30070 DATAYOUR COMPUTER IS THE BIGGEST SELLING HOME COMPUTER MAGAZINE IN THE U.
K.
40040 DATAULTISYNTH 64 IS THE ULTIMATE SYNTHESIZER FOR YOUR COMMODORE 64.(BY Q.
S.)
50000 DATAZ
```

Alas poor Oric

John Morgan,
Mangotsfield,
Bristol.



USING THIS PROGRAM, your Oric will write in the style of William Shakespeare — or J R R Tolkien, or Enid Blyton — without having a clue what it is doing. The result can be fascinating.

After loading the program, you input a sample — the source text — from the writer concerned, and, say, three letters to start things off. The program finds all occurrences of that three-letter string, and selects at random one of the immediately following letters. The process is repeated using the new three-letter string — letters two and three from the starter plus the new letter. And so on, until told to stop.

The general idea is well described in *Scientific American*, November 1983, based on work by W R Bennett Jr.

The source text — up to 5,000 characters long — can be typed straight in. It is automatically sliced into strings of length 240 characters; "#" ends the input. Ping warns if available space is nearly used up. The program will not accept an apostrophe, so backslash — redefined — has to be used.

I have described the program as basing its selection on three letters at a time, but it will request your own choice of control — three and four give the best results.

Warning: the program is slow. Get it running just before a meal or shopping expedition. The results are worth hurrying back for.

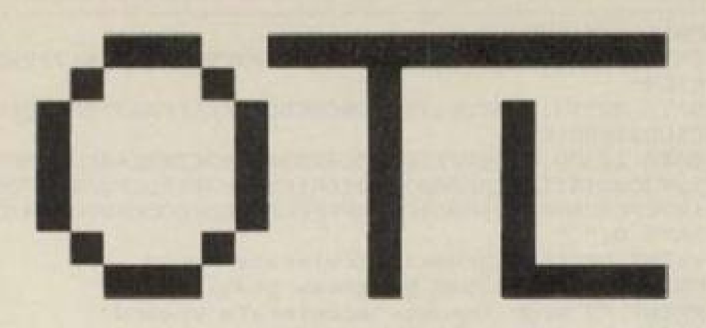
To whet your appetite, here are some samples of Oric's literary efforts.

COOK BEFORE YOU CATCH A SOONES. PEOPLE WHO HESITATES NINE. HALF A STITCH IS ANOTHER MANY COOKS THER THERS NING AS NONES.

Based on a collection of English proverbs.

AND WORLD TOWARD OF ALL THE JUSTICE, AND BELL OF FORMAL CUT,

(continued on page 199)



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BBC DISC UTILITY

For 40 track drives using Acorn DFS only. This program is completely self-documenting, and includes an explanation of Disc layout.

The program allows the Display, Modification and Copying of any Disc sector, including copying to a 2nd Disc using the same drive. It also allows the Disc Directory to be read and altered. It may also be used as a bit copier, and to provide a limited degree of copy protection.

In short, this program allows unrestricted access to the contents of discs at a byte by byte level. All types of file may be worked upon, copied and altered.

Price : £22.00

STOCK CONTROL

For the 48K Spectrum, this comprehensive machine code program allows extensive records to be maintained on more than 500 items. Information stored is:

Item Code (12 char.), Item Description (25 char.), Reorder Level (9 char.), Physical Stock Level (9 char.), Location of Item in Store (9 char.).

The data file is stored separately from the program so that different systems may be maintained concurrently. Data files may be merged and verified. The program is capable of listing either those items below reorder level, or complete files, to screen or printer.

Listings are always in alphanumeric order (determined by stock code).

Price : £15.00 (Program and user documentation).
£5.00 (annotated dissassembly).

TRS80 MODEL I LEVEL II SCREEN EDITOR AND BASIC UTILITY

This machine code utility gives the programmer a user-friendly screen editor within BASIC.

Entry and editing of program and text is made easy. Lines may be quickly re-sequenced and corrected, and the production of many similar lines becomes trivial.

The "CLEAR" key is redefined as a "CONTROL" key, allowing "single key" entry of Basic keywords i.e. "CONTROL" and an alphabetic key pressed together will give an entire word.

The numeric keys, in conjunction with the "CONTROL" keys, may be used as function keys (from Basic only), defined as Z(key no.)$ = "..(function)..".

All keys are also auto-repeat, with a user-definable repeat rate.

Basic programs may be renumbered, with any initial line number and line interval.

Price : £12.50 (cassette).

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FORMULA ONE AND STERRING WHEEL

For Sinclair ZX Spectrum 16K & 48K

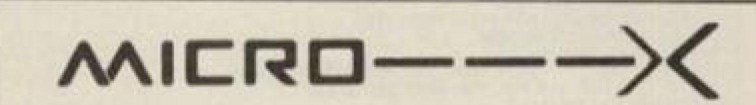
THE GAME

Based on current formula one levels of acceleration, braking and roadholding, with 10 circuits to choose from (one on 16K version) including Silverstone, the world's fastest grand prix circuit. his program has been developed fcr the ultimate in realism with the help of The Jim Russell International Racing Drivers' School at Silverstone. It has four stages — Instruction, Practice, Qualifying, and Race — with eight cars racing against you in wet or dry conditions. Incredible sound effects and smooth 3D action graphics give you all the speed and excitement of motor racing. 100% machine code.

THE STEERING WHEEL

Naturally you cannot steer a racing car effectively by pushing buttons or wiggling a joystick so we have developed a steering wheel that fits to the Spectrum. With one hand on the wheel (the other free for braking and accelerating) it gives the level of precision needed to steer the car on the fastest line through the corners and correct a skid when you overdo it. The wheel is strongly made and thanks to a brilliantly simple design we have been able to keep the cost down to a minimum. It will be used for many game in the future but is now only available with FORMULA ONE.

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(continued from page 197)

MERE OBLIVION NOSE AND BEING FACE,
AND WOFUL BALL SANS EYEBROW.
Shakespeare — *As You Like It.*
IF AN HAPPEN FIRST THE SCREEN IS TO
THAT YOU HAPPENS, SWITCH OFF THE
WORST THE INITIAL SCREEN IS THE
COMPUTER.
Chapter 3 of the Oric Manual.

```
5 REM FOR £ READ HASH CHARACTER
10 REM *** GLOSSOLALIA ***
20 :
30 REM *** J.W.M.MORGAN 1983 ***
40 :
50 HIMEM £97FF:DIM F(60):DIM A$(20)
60 FOR N=0TO2:POKE46816+N,8:NEXT:FORN=3TO7:POKE46816+N
,0:NEXT
70 FOR N=0TO7:POKE 47072+N,0:NEXT:FORN=1TO5:POKE 47078
-N,2^N:NEXT
80 GOTO 2030
90 CLS:PRINT
100 INPUT "CONTROL LENGTH";CL:INPUT "LENGTH OF MESSAGE
";LM
110 PRINT "1ST LETTERS ( AT LEAST "CL") OF MESSAGE":IN
PUT CL$
120 L$=RIGHT$(CL$,CL)
130 CLS:PRINT:PRINT CL$;
140 FOR TT=1 TO LM-CL
150 FORF=0TO60:F(F)=0:NEXTF:TF=0
160 IF A=0 THEN GOTO 210
170 FOR T=0TOA-1
180 T$=A$(T):GOSUB1030
190 T$=RIGHT$(A$(T),CL)+LEFT$(A$(T+1),CL):GOSUB 1030
200 NEXT T
210 T$=A$(A):GOSUB1030
220 RN=RND(1)*TF
230 FOR F=0TO60
240 IF RN<=F(F)THENPRINTCHR$(F+32);:GOTO270
250 RN=RN-F(F)
260 NEXTF
270 IF F=3 THEN L$=LEFT$(A$(0),CL):PRINT " "L$;:GOTO29
0
280 L$=RIGHT$(L$,CL-1)+CHR$(F+32)
290 NEXT TT
300 PRINT:PRINT:PRINT "REPEAT WITH SAME INPUT?(Y/N)"
310 GET K$:IF K$="Y" THEN GOTO 90
999 END
1000 REM *** FREQ TABLE ***
1030 FORN=1TOLEN(T$)-CL
1040 IFMID$(T$,N,CL)=L$THENF=ASC(MID$(T$,N+CL,1))-32:F
(F)=F(F)+1:TF
=TF+1
1050 NEXTN
1060 RETURN
2000 REM ***  SOURCE TEXT  ***
2030 CLS:PRINT:PRINT "ENTER SOURCE TEXT":PRINT "NB USE
 : FOR '"
2040 PRINT "£ WHEN FINISHED":PRINT
2050 GET K$
2060 PRINTK$;:IFASC(K$)>31ANDASC(K$)<93THENA$(A)=A$(A)
+K$:L=L+1
2070 IFASC(K$)=127THENA$(A)=LEFT$(A$(A),LEN(A$(A))-1):
L=L-1
2080 IF K$="£" THEN GOTO 90
2090 IFL=240THENL=0:A=A+1:IFA=19THENPING:PRINT:PRINT"O
NLY 240 MORE"
:PRINT
2100 GOTO2050
```

Python

Andrew Thompson,
Heathfield,
East Sussex.



YOU ARE IN control of a voracious python that slithers around the screen eating food. Each time your snake grabs a mouthful, your score increases and the reptile grows longer.

If you take too long over certain types of food they turn to poison and another block of food appears. If your serpent ever eats some of this poison, it will die.

The food is a light-blue, or cyan, coloured block and poison is dark blue. You earn the right to enter your name in the hall of fame if your score is one of the top 10.

The scroll-left machine-code program is used to store the position to reset the snake's tail and will change it each time you move.

The machine-code change-colour program is responsible for turning appetising food into the lethal poison. At the start of the game you are asked whether the speed-up Poke

POKE 65495,0

works on your computer.

```
10 CLS
20 INPUT"DOES YOUR COMPUTER ACCEPT THE   SPEED UP POKE
 (POKE65495,0)";A$
30 IFLEFT$(A$,1)="Y"THENPOKE65495,0:GOTO50
40 IFLEFT$(A$,1)<>"N"THEN10
50 CLEAR500,29999
60 PCLEAR8
70 FORP=1TO10
80 A$(P)="THE COMPUTER"
90 S(P)=220-P*20
100 NEXT
110 PMODE4,1
120 PCLS0
130 PMODE4,5
140 PCLS0
150 FORP=30000TO30012
160 READA$
170 A$="&H"+A$
180 POKEP,VAL(A$)
190 NEXT
200 DATA0E,06,00,A6,01,A7,80,8C,7F,FC,23,F7,39
210 FORP=31000TO31012
220 READA$
230 A$="&H"+A$
240 POKEP,VAL(A$)
250 NEXT
260 DATA0E,1E,00,A6,01,A7,80,8C,7F,FE,23,F7,39
270 FORP=32000TO32024
280 READA$
290 A$="&H"+A$
300 POKEP,VAL(A$)
310 NEXT
320 DATA0E,04,00,A6,80,81,BF,27,06,8C,05,FF,23,F5,39,8
6,AF,A7,1F,8C,05,FF,23,EB,39
330 FORP=32500TO32524
340 READA$
350 A$="&H"+A$
360 POKEP,VAL(A$)
370 NEXT
380 DATA0E,04,00,A6,80,81,60,27,06,8C,04,5F,23,F5,39,8
6,20,A7,1F,8C,04,5F,23,EB,39
390 GOTO1240
400 H=100
410 Z=0
420 B$=""
430 POKE32764,6
440 POKE32765,1
450 POKE32766,30
460 POKE32767,1
470 CLS0
480 PRINT@10,"SCORE=";
490 PRINT@16,0;
500 FORP=1TO62
510 SET(P,3,8)
520 SET(P,30,8)
530 NEXT
540 FORP=3TO30
550 SET(1,P,8)
560 SET(62,P,8)
570 NEXT
580 GOSUB970
590 Q1=3
600 Q2=0
610 X=1+RND(60)
620 Y=3+RND(25)
630 A=RND(3)-2
640 B=0
650 SC=0
660 IFA=0THENB=RND(3)-2:IFB=0THEN660
670 X=X+A:Y=Y+B
680 IFPOINT(X,Y)=6THENPOKE1024+S+T*32,128:Z=0:H=H-1:SO
UND1,1:GOSUB970:SC=SC+1:PRINT@16,SC;:Q1=Q1+1:IFQ1>255T
HENQ1=0:Q2=Q2+1:IFQ2>23THENQ2=23
690 IFH<50THENH=50
700 IFPOINT(X,Y)<>0THEN910
710 Z=Z+1:IFZ>H THENZ=0:EXEC32000:SOUND100,1:GOSUB970
720 SET(X,Y,7)
730 Q=Q2*256+Q1
740 POKE1536+Q,X
750 POKE7680+Q,Y
760 POKE32764,6+Q2
770 POKE32766,30+Q2
780 POKE32765,Q1
790 POKE32767,Q1
800 A$=INKEY$
810 IFA$="A"THENA=0:B=-1
820 IFA$="Z"THENA=0:B=1
830 IFA$="L"THENA=-1:B=0
840 IFA$=";"THENA=1:B=0
850 EXEC30000
860 EXEC31000
870 UU=PEEK(1536)
880 VV=PEEK(7680)
890 RESET(UU,VV)
900 GOTO670
910 AA=POINT(X,Y)
920 IFAA=3THEN1020
930 IFAA=7THEN1050
940 IFAA=8THEN1080
950 POKE1024+S+T*32,128:SOUND1,1:GOSUB970:SC=SC+1:PRIN
T@16,SC;:Q1=Q1+1:IFQ1>255THENQ1=0:Q2=Q2+1:IFQ2>23THENQ
2=23
960 GOTO700
970 S=RND(30)
980 T=RND(14)
990 IFRIGHT$(HEX$(PEEK(1024+S+T*32)),1)<>"0"THEN970
1000 POKE1024+S+T*32,223
1010 RETURN
1020 CLS3
1030 PRINT@38,"YOU ATE SOME POISON";
1040 GOTO1110
1050 CLS7
1060 PRINT@35,"YOU CRASHED INTO YOURSELF";
1070 GOTO1110
1080 CLS8
1090 PRINT@40,"YOU HIT THE SIDE";
1100 GOTO1110
1110 PRINT@103,"YOUR SCORE IS"SC;
1120 FORP=1504TO1535
1130 POKEP,96
1140 NEXT
1150 PRINT@480,"PRESS THE SPACEBAR";
1160 FORP=1504TO1535
1170 NO=PEEK(P)
1180 IFNO<64THENNO=NO+64ELSENO=NO-64
1190 POKEP,NO
1200 NEXT
1210 A$=INKEY$
1220 IFA$<>" "THEN1160
1230 IFSC>S(10)THEN1430
1240 CLS
1250 PRINT@41,"hall of fame";
1260 EXEC32500
1270 FORP=1TO10
1280 PRINT@P*32+106-LEN(STR$(S(P))),S(P)TAB(11)A$(P);
1290 NEXT
1300 PRINT@480,"PRESS THE SPACEBAR";
1310 FORP=1504TO1535
1320 NO=PEEK(P)
1330 IFNO<64THENNO=NO+64ELSENO=NO-64
1340 POKEP,NO
1350 NEXT
1360 A$=INKEY$
1370 IFA$<>" "THEN1310
1380 PMODE4,1
1390 PCLS0
1400 PMODE4,5
1410 PCLS0
1420 GOTO400
1430 FORP=9TO1STEP-1
1440 IFSC<=S(P)THENU=P+1:P=1
1450 NEXT
1460 IFSC>S(1)THENU=1
1470 FORP=9TOU STEP-1
1480 S(P+1)=S(P)
1490 A$(P+1)=A$(P)
1500 NEXT
1510 S(U)=SC
1520 A$(U)=""
1530 CLS
1540 PRINT@40,"enter your name";
1550 EXEC32500
1560 FORP=1TO10
1570 PRINT@P*32+106-LEN(STR$(S(P))),S(P)TAB(11)A$(P);
1580 NEXT
1590 V=107+U*32
1600 Q=0
1610 A$=INKEY$
1620 FORNN=1TO2
1630 NO=PEEK(1024+V+Q)
1640 IFNO>64THENNO=NO-64ELSENO=NO+64
1650 POKE1024+V+Q,NO
1660 NEXT
1670 IFA$=CHR$(13)THEN1770
1680 IFA$>="A"ANDA$<="Z"THENA$=CHR$(ASC(A$)-64):GOTO17
30
1690 IFA$>="0"ANDA$<="9"THEN1730
1700 IFA$=" "THEN1730
1710 IFA$=CHR$(8)ANDQ>0THENIFQ<19THENQ=Q-1:POKE1024+Q+
V,96ELSEPOKE1024+Q+V,96:Q=Q-1:POKE1024+Q+V,96
1720 GOTO1610
1730 POKE1024+Q+V,ASC(A$)+64
1740 Q=Q+1
1750 IFQ>19THENQ=19:SOUND1,1
1760 GOTO1610
1770 FORP=1024+V TO1024+Q+V
1780 A=PEEK(P)-64
1790 IFA<27THENB$=B$+CHR$(A+64):NEXT:GOTO1820
1800 IFA=32THENB$=B$+" ":NEXT:GOTO1820
1810 IFA<>96THENB$=B$+CHR$(A):NEXT
1820 IFLEN(B$)=21THENB$=LEFT$(B$,20)
1830 A$(U)=B$
1840 GOTO1240
```

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BRAINTEASER AND COMPETITION RESULTS

THE RESULT of November's brainteaser, 39 Steps over the Buchan River, has been held over from last month's report. So for those of you who racked their brains over the puzzle here is the missing report.

39 steps winner

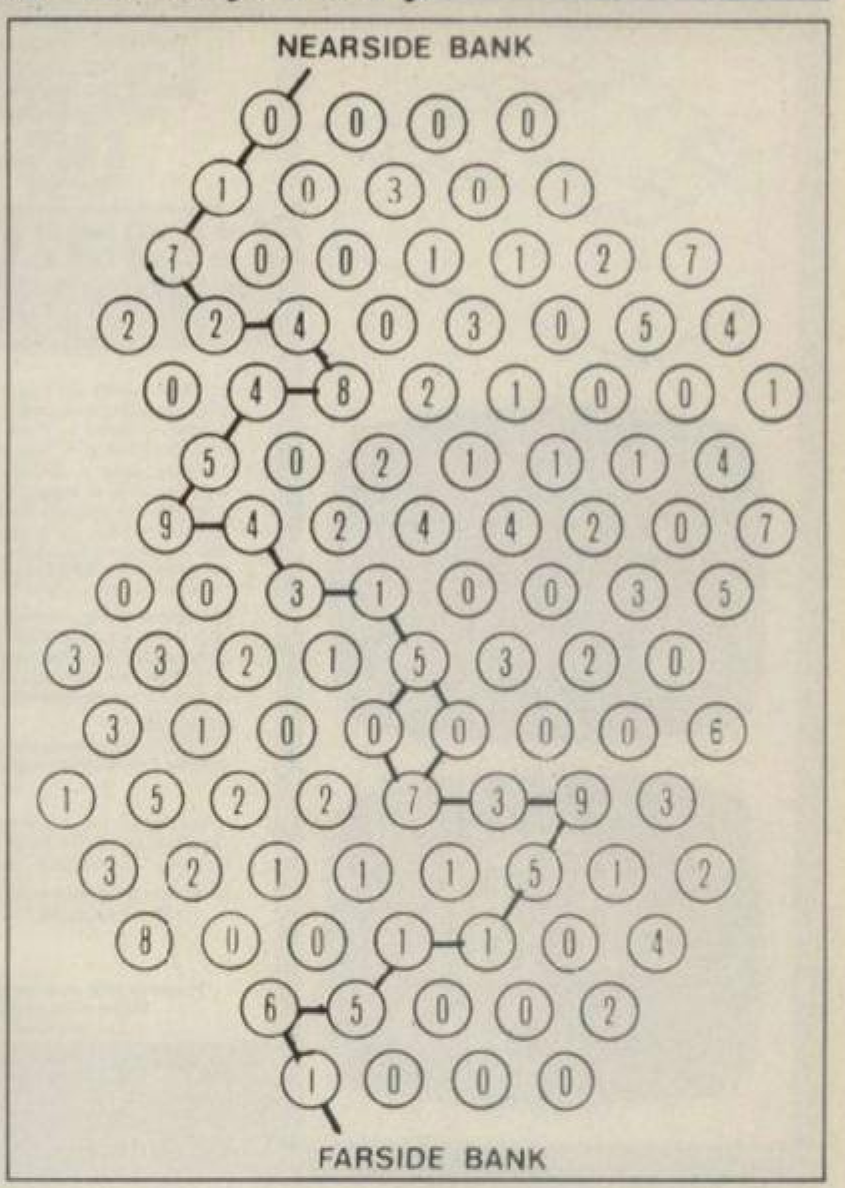
The problem did not lend itself to a program solution — or at least not on a home computer. With over a hundred nodes to pick a route from the number of possible permutations is astronomical. A more feasible approach was to look for short pieces of route that were worth taking. These would include stones with 9, 8 and 7 crystals on them. Connecting them involved hunting out associated 6s and 5s.

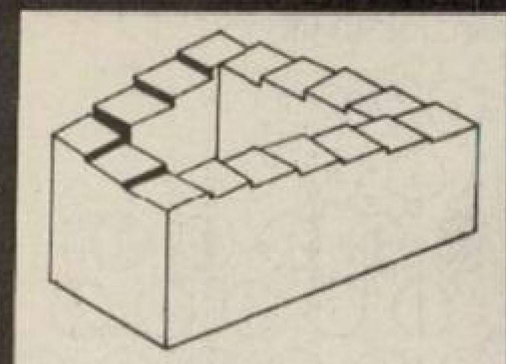
J Barker, 6 Amadis Road, Keepers Lodge Estate, Beaumont Leys, Leicester, wins the £15 book token for a route which brought in 84 crystals. His route, shown below, picks up the following sequence of stones: 7,4,8,4,5,9,4,3,5,7,3,9,5,5,6. 24 steps are taken and 15 pickups are made. Each pickup is equivalent to an extra step giving 39 steps in all.

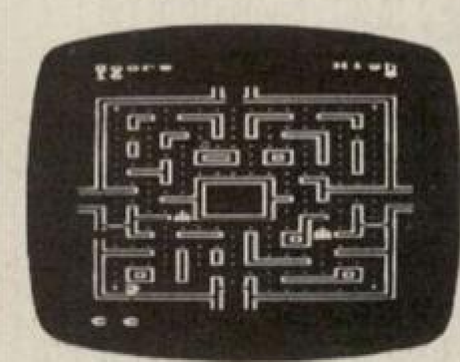
Several entries claimed higher totals but were flawed because they neglected to include the step from the last stone to the farside bank.

Microdrive winner

The winner of the second Microdrive in November can now be named. Two drives and not one were on offer. This is good news for P Howells, 57 Yarnells Hill, Oxford OX2 9BE. His entry, "Load time will dive, from 50 seconds to five, thanks to Sir Clive", previously a runner-up now wins him a Microdrive.











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October Issue — GAMES — **Munch-Man**, a Snapper type game with super graphics, Illusions graphics and sound you won't believe. A Versatile **Renumber** program for Basic, **Fabric Patterns**, an invisible **Alarm Clock**, **Disc Sector String Search** and a program for drawing **3D Surfaces**. Articles on the **Teletext Mode** for beginners, **Compilers and Interpreters**, using **Joysticks**, using the **Speech Synthesizer** and more. Reviews of two **Cassette Recorders** (Marantz Superscope C190 and Acorn Data Recorder), three **Printers** (NEC pc-8023B, Star DP840 and CP-80), and lots of new games software (and we've arranged **SPECIAL OFFERS** for members). Plus a review of the new **Acorn Electron** and news of our new magazine for Electron users called **ORBIT**. Plus all our usual features like Hints and Tips, Postbag, and a new Brainteaser.

December Issue — **Program Features: Killer Dice** game, **Galactic Invasion**, a fast moving space invasion game, **LINK**, a very useful disc utility for program development, **ASTAAD**, a really excellent program for **Computer Aided Design**, the **Percussion Machine**, moving **Chequer Board** display, **Screen Freezer**, a routine to freeze your favourite game in mid-play, and a musical rendering of the **Twelve Days of Christmas** to add a seasonal flavour. Plus articles on the **Teletext Mode** (part 3) and **Fitting an External Speaker**. Plus **Disc Drive Reviews**, **Book Reviews**, Hints and Tips.

STOP PRESS
BEEBUG has negotiated a deal with ACORN over the new 1.2 OPERATING SYSTEM ROM. BEEBUG members are offered the ROM at around half-price. See BEEBUG Feb. Issue for details.

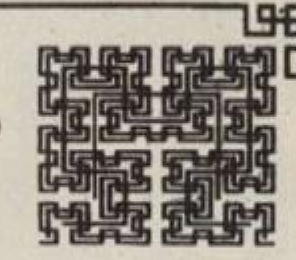
SOFTWARE DETAILS
BEEBUGSOFT: BEEBUG SOFTWARE LIBRARY
offers members a growing range of software from £3.50 per cassette. 1. Starfile (32K). 2. Moonlander (16K). 3D Noughts and Crosses (32K). 3. Shape Match (18K). **Mindbinder** (16K). 4. Magic Eel (32K). 5. Cylon Attack (32K). 6. Astro-Tracker (32K). **Utilities:** 1. Dissembler (16K). Redefine (16K). Mini Text Ed (32K). **Applications:** 1. Superplot (32K). 2. Masterfile (32K).

Magazine programs now available on cassette to members at £3.50 inc: VAT & p+p — see April/May issue for details.

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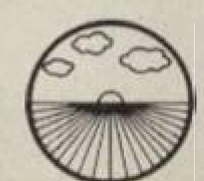
"... 'I haven't seen any other compiler that could match Hisoft's Pascal" ... *Using the Spectrum Micro — Autumn 1983*
"This is a very impressive product ... of benefit to any Spectrum programmer ..." *David Bolton ZX COMPUTING Aug/Sept 1983*
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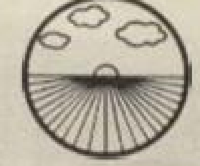
"... DEVPAC is most highly recommended. The documentation is first class." *Your Computer May 1983*
"... if you write programs in machine code, buy DEVPAC — it is the best currently on the market." *Adam Denning, ZX SOFT in Which Micro September 1982*
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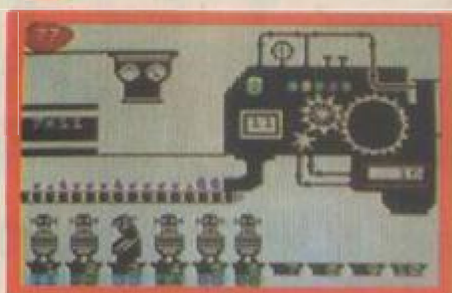
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Interceptor "Crazy Kong" £6.00
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BBC

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ORIC

Softek "Dracula's Revenge" £6.95
UK Software "Zorgon's Revenge" £8.50
Martech "Harrier Attack" £6.95

DRAGON 32

Softek "Ugh!" £8.95
J Maurice Micros "Maurice Minor" £7.95

SUNSHINE

Cruising (Dragon 32) £6.95
Cruising (ZX Spectrum) £4.95
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DRAGON

The King £8.00
Space War £8.00
Defence £8.00
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Katerpillar Attack £8.00
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Lost in Space (Dragon, BBC, Oric) £9.95
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Grand Prix (Dragon) £7.95
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Golf (Dragon) £7.95
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PHOENIX Amber (Normally £126.50) . **£82.95**
COMMODORE 1701 with sound **£230.00**
SANYO 14" Colour TV (ideal as a monitor) **£229.95**
SANYO CDD 3125NB Colour Monitor . **£285.35**
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GRANADA PERSONAL COMPUTING TITLES

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The Spectrum Programmer £5.95
The Spectrum Book of Games £5.95
Introducing Spectrum Machine Code £7.95
The Apple II Programmer's Handbook £10.95
Programming with Graphics £5.95
The Dragon & how to make the most of it £5.95
Computing for the Hobbyist & small Business £6.95
Simple Interfacing Projects £6.95
The BBC Micro: An expert guide £6.95
Commodore 64 Computing £5.95
The Oric-1 and how to get the most from it £5.95
The Dragon 32 book of games £5.95
Computer Languages and their uses £5.95
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Choosing a Microcomputer £4.95
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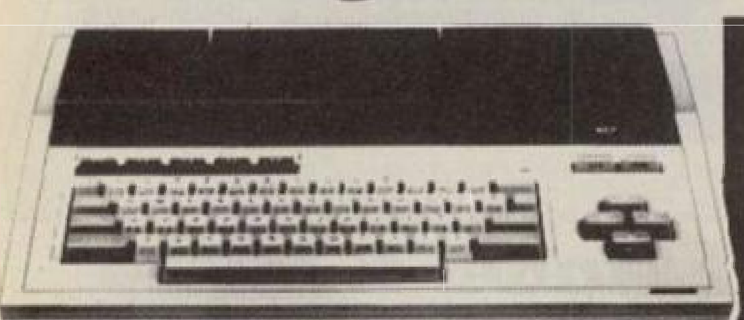
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The Working Spectrum £5.95
Functional Forth for the BBC £5.95
The Working Dragon 32 £5.95
Dragon 32 Games Master £5.95
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The Working Spectrum £5.95
The Working CBM 64 £5.95
Dragon 32 Games Master £5.95
and many more!

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

Turn the page for more super offers from Spectrum . . .

spectrum



SHARP MZ-711

(MZ-700 Series Computer)
FREE! 10 CASSETTE BASED GAMES

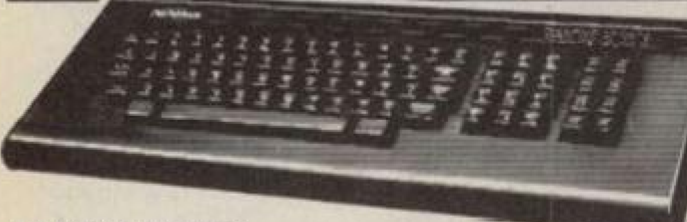
The super new colour computer from SHARP. Now available in limited quantities - including 10 FREE CASSETTE BASED GAMES from SPECTRUM

SPECTRUM PRICE £249.95

SHARP PRINTER .... £129.95 CASSETTE RECORDER £39.95

SHARP MZ80A £399

MEMOTECH MTX 512



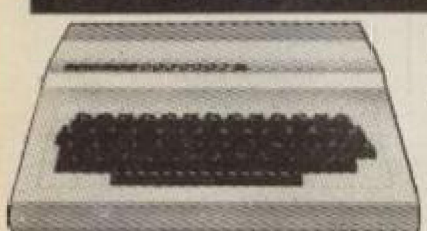
WITH FREE!
BLANK DATA CASSETTE
2 GAMES, HEAD CLEANER,
DEMONSTRATION
CASSETTE.

SPECTRUM PRICE £315

Also available MTX 500 £275

SOFTWARE
• SUPER MINEFIELD • CONTINENTAL INVADERS • KILOPEDE • MATHS 1 • PHYSICS 1 • FLIGHT SIMULATOR • CHESS • OTHELLO

DRAGON 32 OFFER



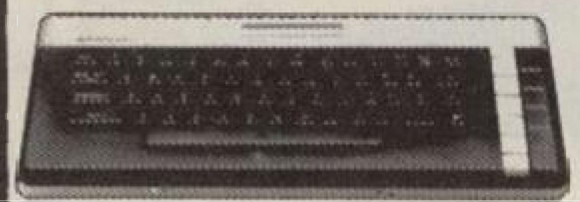
DRAGON PACK
Including:
DRAGON 32, Computer Cassette Recorder, Joysticks and Dragon Games Pack.

ALL FOR ONLY £199.99

Check with your local SPECTRUM dealer for price of seperate items.

DRAGON 64 £225.00

ATARI 600XL



• 16K RAM expandable to 48K • Full-stroke keyboard • Full sound with 3½ octave range • 11 Graphic Display modes • Full colour (256 Colours - 128 colours can be displayed at one time) Ask to see this super new micro at your local SPECTRUM dealer NOW!
SPECTRUM PRICE

SPECTRUM PRICE £159.99

1010 CASSETTE RECORDER	£49.99
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1027 LETTER QUALITY PRINTER	£299.99
1020 PRINTER PLOTTER	£199.99
TOUCH TABLET, TRACK BALL	£39.99
SOFTWARE	£29.99
DIG DUG	£29.99
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TI-99/4A

Exceptional value from SPECTRUM and representing probably the finest home micro computer value on the market today! - The TEXAS TI-99/4A is built to an extremely high standard and is highly recommended by SPECTRUM for its utter reliability.

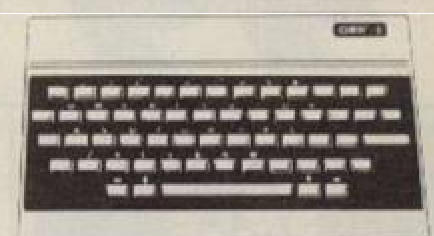
CHECK WITH YOUR LOCAL SPECTRUM DEALER FOR OUR SUPER LOW PRICE

Wide range of software available for TEXAS from your local SPECTRUM dealer.

ACCESSORIES

C12 DATA CASSETTES	£0.50
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DISK HEAD CLEANER KIT	£16.10
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ORIC-1



ORIC-1 48K Model

SPECTRUM PRICE £139.95

ORIC-1 16K £99.95

HALF PRICE OFFER!

Bring a copy of this ad to your local SPECTRUM dealer when you purchase an ORIC-4 48K or 16K and it will entitle you to purchase the following 4 titles of Software in a starter pack.

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HOBBIT	£14.95
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CS100E	£217.35
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CS200	£881.75

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CDS250	£365.95
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Everything you've ever wanted for your

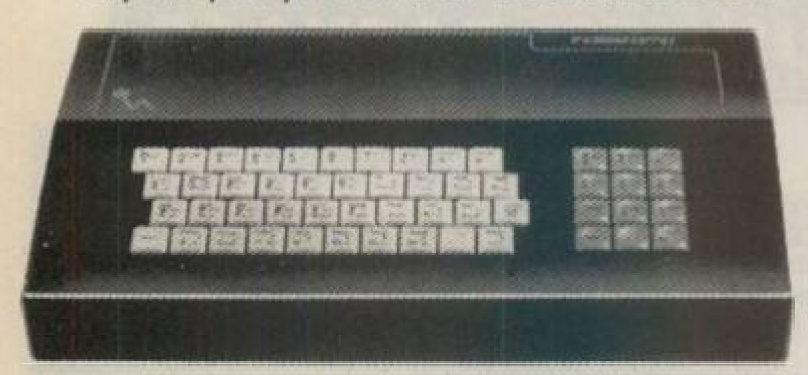
ZX SPECTRUM

Superb ZX add-on's from your local Spectrum dealer

New & exclusive to Spectrum!

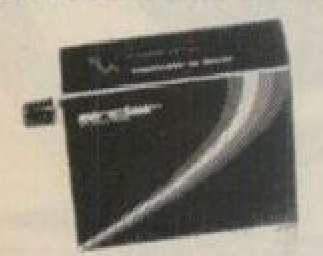
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Superb quality add-on's for the ZX SPECTRUM



INDESCOMP KEYBOARD WITH FULLY ADJUSTABLE SOUND **£59.95**

INDESCOMP SOUND AMPLIFIER



ONLY £10.95

INDESCOMP JOY STICK INTER-FACE



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INDESCOMP 32K RAM PACK



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INDESCOMP DOMESTIC CONTROL-LER



£49.95

INDESCOMP RS232 & CENTRONICS PRINTER INTERFACE £49.95

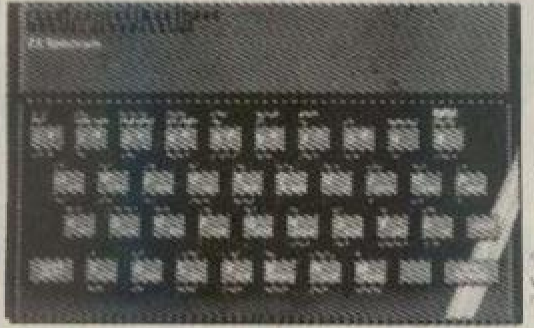
ALPHACOM Thermal Printer for ZX SPECTRUM - NOW DOWN TO £59.95

DIGITAL TRACER



From RD Labs for the ZX Spectrum

£55.50



ZX SPECTRUM 16K £99.95

ZX SPECTRUM 48K £129.95

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VISCOUNT DISK DRIVE

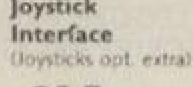
Now from SPECTRUM a Disk Drive for the ZX SPECTRUM. The VISCOUNT 5¼" DISK DRIVE with interface system and complete with all leads.

ONLY £245

DK TRONICS Dual Port Joystick Interface

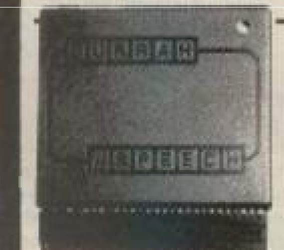
£14.95

KEMPSTON Joystick Interface (Joysticks opt. extra)



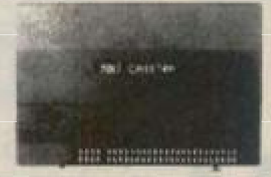
£15

Joysticks with interface £24.95
Centronics Interface......... £45.00



CURRAH Speech Synthesiser **£29.95**

CHEETAH 32K RAM Pack **£39.95**



DK'TRONICS Keyboard £45.00
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STACKLIGHT Rifle with 3 FREE GAMES £29.95

PRISM VTX 5000 MODEM



Now, your ZX SPECTRUM is your key to the world with the incredible PRISM VTX 5000 MODEM

■ Versatile modem for ZX Spectrum (16K or 48K) versions ■ Slim design fits easily, matches your micro ■ Instant access to Prestel™ & Micronet 800 information services ■ Instant communication with other ZX Spectrum users ■ Use the Prism VTX 5000 with a Sinclair printer - and print Prestel frames. Ask your local SPECTRUM dealer for further details - NOW!

SPECTRUM PRICE **£99.95**

Sinclair ZX INTERFACE 2

The new ROM Cartridge/Joystick interface. Loads programs instantly! Takes two joysticks! Just plug in and play.

ONLY £19.95

Plus! New ROM cartridge software.

Turn the page for more super offers from Spectrum . . .

spectrum

NEWS from SPECTRUM

January is SALE time!

January is SALE TIME and apart from the many January SUPER-DEAL offers featured in these ads most SPECTRUM dealers will be holding their own individual sales too, with big savings on a wide range of products. So for the best deal in HOME COMPUTERS - see your local SPECTRUM dealer NOW!

Sensational PRINTER OFFER

Amazing Value! SEIKOSHA GR100 Mk. 11 plus FREE! box of paper (2000 sheeets) and all for under £200, see our ad for details.

Just arriving! COMMODORE 64 PORTABLE

with built-in monitor, single disk drive. Plus! FREE! Future Finance & Easy script programs. Very limited supplies at only £899.00 See your local SPECTRUM dealer now!

DISK DRIVE for ZX SPECTRUM

Now from SPECTRUM a Disk Drive for the ZX SPECTRUM exclusive to SPECTRUM stores see our ad for ful details

LATEST NEWS

• For up-to-date news, information & offers from SPECTRUM - see PRESTEL page 600181 for full details.

COMPUTER DEALERS

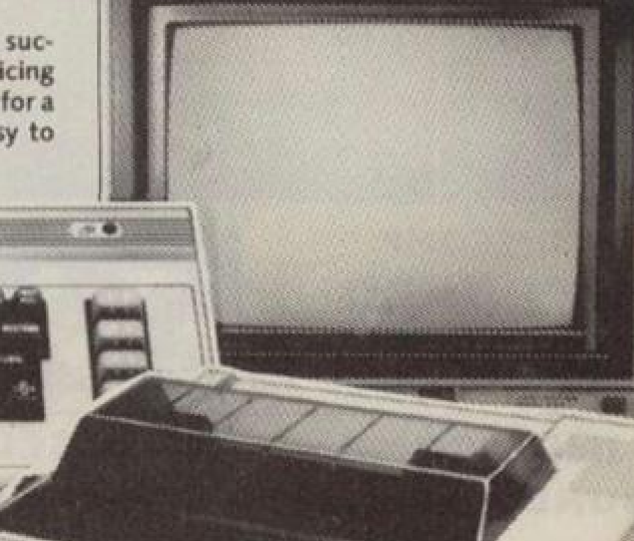
(or prospective Computer dealers!) If, you would like to know more about becoming a SPECTRUM APPOINTED DEALER on an exclusive area basis, please write to MIKE STERN, Spectrum (UK) Ltd., Burrowfield, Welwyn Garden City, Herts. or telephone (07073) 34761

January SUPER DEAL Offer!

COMMODORE 64 BUSINESS PACKAGE

SAVE £350!

A complete business package based on the successful Commodore 64, including Sales/Invoicing and purchase ledger programs. All you need for a small business system that's extremely easy to understand and ready to run.



Includes

- COMMODORE 64
- DISK DRIVE
- COLOUR MONITOR
- COMMODORE PRINTER
- PURCHASE LEDGER PROGRAM
- SALES LEDGER PROGRAM
- EASY SCRIPT PROGRAM

Plus!

- FREE! GAMES DISK WITH SIX GAMES

FOR THE SMALL BUSINESSMAN . . . this has to be the business computer opportunity of a lifetime! This superb, top-value package includes everything you need to set up your own powerful small business/home Micro system.

There's the high-power Commodore 64 computer with its huge 64K RAM memory built-in and brilliant graphics capability, with full colour. The system's completed with a Commodore disk drive - store your entire filing system, accounts, sales records, etc. -plus tractor-feed printer, and a 1701 colour monitor.

It really is tremendous package - at SPECTRUM'S incredible low price, it's unbeatable!

ALL THIS FOR ONLY £899.95

All items can be purchased seperately - ask your local SPECTRUM dealer for price.

FOR THE COMMODORE 64 HOME USER

VIC 1452 Printer Plotter - Special January Offer... £99.99
COMMODORE 64 with 4 FREE GAMES £199.99
SINGLE DISK DRIVE with FREE Easy Script and Future Finance programs.................. £230.00
AZTEC Centronics Interface...................... £29.90
VISCOUNT Cassette Interface £12.95
Plus! 100's of Software Titles now available.

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

There's a Spectrum Centre near you . .

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Bristol Brensal Computers Ltd., 24 Park Row Tel: (0272) 294188
Weston-Super-Mare K & K Computers, 32 Alfred St Tel: (0934)419324

BEDFORDSHIRE

Bedford Stanad Ltd., 115 Midland Rd. Tel: (0234) 49341
Dunstable Dormans 7-11 Broad Walk Tel: (0582) 65515
Leighton Buzzard The Computer Centry at Milton Keynes Music, 17 Bridge St Tel. (0525)376622
Luton Terry-More, 49 George St Tel: (0582) 23391/2

BERKSHIRE

Reading David Saunders, 8 Yield Hall Place Tel: (0734) 580719

BUCKINGHAMSHIRE

Bletchley Rams Computer Centre, 117 Queensway. Tel: (0908) 647744
Chesham Reed Photography & Compute's, 113 High St. Tel: (0494) 783373

CAMBRIDGESHIRE

Cambridge K P Computers Ltd 19/20 Market St. Tel: (0223) 312240
Peterborough Peterborough Communications, 91 Midland Rd. Tel: (0733) 41007

CHANNEL ISLANDS

Guernsey Gruts, 3-5 The Pollett, St Peter Port. Tel: (0481) 24682
Jersey Audio & Computer Centre, 7 Peter St. St Helier. Tel: (0534) 74000

CHESHIRE

Altrincham Mr Micro 28 High St Tel: (061) 941 6213
Chester Oakleaf Computers Ltd 100 Boughton Tel: (0244) 310099
Crewe Microman Unit 2, 128 Nantwich Rd. Tel: (0270) 216014
Macclesfield Camera & Computer Centre 118 Mill St. Tel: (0625) 27468
Northwich Camera & Computer Centre, 3 Town Square Tel: (0606) 45629
Stockport Wilding Ltd. 1 Little Underbank Tel: (061) 480 3435
Warrington Wildings, 111 Bridge St. Tel: (0925) 38290
Widnes Computer City, 78 Victoria Road. Tel: (051) 420 3333
Wilmslow Swift of Wilmslow, 4-6 St. Annes Parade. Tel: (0625) 526213

CLEVELAND

Middlesborough McKenna & Brown, 206 Linthorpe Rd. Tel: (0642) 222368

CORNWALL

St Austell A B & C Computers, Duchy House, 6 Lower Aylmer Sq. Tel: (0726) 67337

CUMBRIA

Barrow-in-Furness Barrow Computer Centre. 96 Church St. Tel: (0229) 38353
Carlisle The Computer Shop, 56-58 Lowther St. Tel: (0228) 27710
Penrith Penrith Communications, 14 Castlegate. Tel: (0768) 67146 Open Mon-Fri till 8pm
Whitehaven P D Hendren 15 King St. Tel: (0946) 2063

DERBYSHIRE

Alfreton Gordon Harwood 69-71 High St. Tel: (0773) 832078
Chesterfield The Computer Centre, 14 Stephenson Place Tel: (0246) 208802
Derby C T Electronics, at Camera Thorpe, The Spot Tel: (0332) 360456

DEVON

Exeter Seven Counties (Computers) Ltd., 7 Paris Street. Tel: (0392) 211212
Exmouth Open Channel, 30 The Strand. Tel: (0395) 264408
Plymouth Syntax Ltd. 76 Cornwall St. Tel: (0752) 28705
Tiverton Actron Micro Computers, 37 Bampton St. Tel: (0884) 252854
Torquay Devon Computers, 8 Torhill Rd., Castle Circus. Tel: (0803) 526303

DORSET

Bornemouth Lansdowne Computer Centre 1 Lansdowne Crescent. Tel: (0202) 20165

DURHAM

Darlington McKenna & Brown, 102 Bondgate. Tel: (0325) 459744

ESSEX

Basildon Godfrey's 28-32 East Walk, Tel: (0268) 289379
Basildon Godfrey's Computer Centre, 5 Laindon Main Centre Laindon. Tel: (0268) 416747
Chelmsford Maxton Hayman Ltd., 5 Broomfield Rd. Tel: (0245) 354595
Colchester Colchester Computer Centre 16 St. Botolphs St. Tel: (0206) 47242
Grays H Reynolds. 79 Orsett Rd. Tel: (0375) 5948
Ilford Woolfmans, 76 Ilford Lane. Tel: (01) 478 1307
Loughton Micro & Movie Channel 309 High Rd. Tel: (01) 508 1216

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Gloucester The Model Shop, 79-81 Northgate St. Tel: (0452) 410693

HAMPSHIRE

Aldershot David Saunders, 51 Station Rd., Tel: (0252) 20130
Andover Andover Audio, 105 High St. Tel: (0264) 58251
Basingstoke Fisher's, 2-3 Market Place. Tel: (0256) 22079
Portsmouth Cygnus Computers Ltd. 261 Commercial Rd., Tel: (0705) 833938
Portsmouth (Waterlooville) G B Microland, 7 Queens Parade. Tel: (07014) 59911
Southampton RJ Parker & Son Ltd. 11 West End Rd., Bitterne. Tel: (0703) 445926
Winchester Winchester Camera & Computer Centre, 75 Parchment St. Tel: (0962) 53982

HEREFORD

Hereford Melgray Hi-Tech Ltd., 49 Broad St. Tel: (0432) 275737

HERTFORDSHIRE

Borehamwood Master Micro, 36 Shenley Rd. Tel: (01) 953 6368
Hitchin Camera Arts (Micro Computer Division), 68A Hermitage Rd., Tel: (0462) 59285
Potters Bar The Computer Shop, 197 High St. Tel: (0707) 44417
St Albans (Herts) Clarks Computer Centre 14-16 Hollywell Hill Tel: (0727) 52991
Stevenage D J Computers, 11 Town Square. Tel: (0438) 65501
Watford SRS Microsystems Ltd., 94 The Parade, High St. Tel: (0923) 26602
Welwyn Garden City D J Computers, 40 Fretherne Rd., Tel: (07073) 28435/28444

HUMBERSIDE

Beverley Computing World, 10 Swaby's Yard Dyer Lane. Tel: (0482 881831
Grimsby RC Johnson Ltd., 22 Friargate, Riverhead Centre. Tel: (0472) 42031
Hull The Computer Centre 26 Anlaby Rd. Tel: (0482) 26297

ISLE OF MAN

Douglas T H Colebrum Ltd. 57-61 Victoria St. Tel: (0624) 3482 (Just Opening)

ISLE OF WIGHT

Cowes Beken & Son. 15 Bath Rd. Tel: (0983) 297181

KENT

Canterbury Kent Micro Systems, Conquest House, 17 Palace St. Tel: (0227) 50200
Dover Kent Photos & Computers, 4 King St. Tel: (0304) 202020
Orpington Ellis Marketing Ltd., 25 Station Sq., Petts Wood. Tel: (0689) 39476
Rainham Microway Computers Ltd., 39 High St. Medway Towns Tel: (0634) 376702
Sevenoaks Ernest Fielder Computers, Dorset St. Tel: (0732) 456800
Sittingbourne Computers Plus, 65 High St. Tel: (0795) 25677
Tunbridge Wells Modata Computers Ltd. 28-30 St Johns Rd. Tel: (0892) 41555

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Accrington PV Computers, 38A Water St. Tel: (0254) 36521/32611
Blackburn Tempo Computers, 9 Railway Rd. Tel: (0254) 691333
Burnley IMO Computer Centre, 39/43 Standish St BB11 1AP Tel: (0282) 54299
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Leicester Youngs, 40/42 Belvoir St. Tel: (0533) 544774
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Lincoln MKD Computers, 24 Newlands, Tel: (0522) 25907

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E8 McGowans, 244 Graham Rd., Hackney. Tel: (01) 533 0935
EC1 Sidney Levy, 17-19 Leather Lane. Tel: (01) 242 3456
EC2 Devron Computer Centre, 155 Moorgate Tel: (01) 638 3339/1830
N14 Logic Sales, 19 Broadway, The Bourne, Southgate. Tel: (01) 882 4942
N20 Castlehurst Ltd. 1291 High Rd. Tel: (01) 446 2280
NW4 Da Vinci Computer Store, 112 Brent St., Hendon Tel: (01) 202 2272
SE1 Vic Odden's 6 London Bridge Walk. Tel: (01) 403 1988
SE9 Square-Deal, 373-375 Footscray Rd. New Eltham. Tel: (01) 859 1516
SE11 Gatwick Computers, 328 Kennington Park Rd. Tel: (01) 587 0336 Adjacent to Oval Tube
SE15 Castlehurst Ltd., 152 Rye Lane, Peckham. Tel: (01) 639 2205
SE25 Ellis Marketing, 79 High St., South Norwood. Tel: (01) 653 4224
SW6 Chelsea Micros Ltd. 14 Jerdan Place. Next to Fulham B/way Tel: (01) 385 8494
SW16 Buffer Micro Shop, 310 Streatham High Rd. Tel: (01) 769 2887
SW19 Emcom, 31 High St., Wimbledon. Tel: (01) 947 7678
W1 Computers of Wigmore St., 87 Wigmore St. Tel: (01) 486 0373
W1 GK Photo & Computers, 92-94 Wardour St. Tel: (01) 437 0182
W1 Devron, 4 Edgware Rd. Tel: (01) 724 2373
W1 Sonic Foto & Micro Centre, 256 Tottenham Court Rd. Tel: (01) 580 5826
W1 Computer Plus, 219 Regent St. Tel: (01) 437 1071/4
W7 TK Electronics, 11/13 Boston Rd., Hanwell. Tel: (01) 579 2842
WC2 City Camera Exchange, 115 Kingsway Tel: (01) 405 0446

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Bolton Wilding Ltd., 23 Deansgate. Tel: (0204)33512
Hyde Pase, 213-215 Market St. Tel: (061) 366 5935
Manchester Lomax Ltd., 8 Exchange St St. Ann's Square. Tel: (061) 832 6167
Oldham Home & Business Computers Ltd., 54 Yorkshire St. Tel: (061) 6331608
Rochdale Home & Business Computers, 75 Yorkshire St. Tel: (0706) 344654
Swinton Mr Micro Ltd., 69 Partington Lane. Tel: (061) 728 2282 Late Night Friday
Wigan Wilding Ltd., 11 Mesnes St. Tel: (0942) 44382

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Birkenhead Fairs Cameras & Hi-Fi, Dacre Hill, Rock Ferry. Tel: (051) 645 5000
Heswall Thornguard Computer Systems, 46 Pensby Rd. Tel: (051) 342 7516
Huyton Ian Houghton 5 Huyton Hey Rd. Tel: (051) 489 5785
Liverpool Beaver Radio, 20-22 Whitechapel. Tel: (051) 709 9898
Liverpool (Aintree) Hargreaves, 31-37 Warbreck Moor. Tel: (051) 525 1782
Southport Central Computers, 575 Lord St. Tel: (0704) 31881
St Helens Studio 55, 55 Ormskirk St. Tel: (0744) 39496

MIDDLESEX

Edgware Breaker 1-4, 130 High St. Tel: (01) 952 7488/8860
Harrow Camera Arts, (Micro Computer Division) 24 St Annes Rd. Tel: (01) 427 5469
Hayes Chipstop, 1000 Uxbridge Rd. Tel: (01) 573 2511 (Just Opening)
Teddington Andrews, Broad St. Tel: (01) 977 4716
Uxbridge J K L Computers, 7 Windsor St. Tel: (0895) 51815

NORFOLK

Fakenham Fastview, 12 Norwich Rd. Tel: (0328) 51319
Norwich Sound Marketing, 52 St. Benedicts St. Tel: (0603) 667725
Thetford C B & Micros, 21 Guidhall St. Tel: (0842) 61645

NORTHAMPTONSHIRE

Northampton Dormans, 22 Princes Walk Grosvenor Centre. Tel: (0604) 37031

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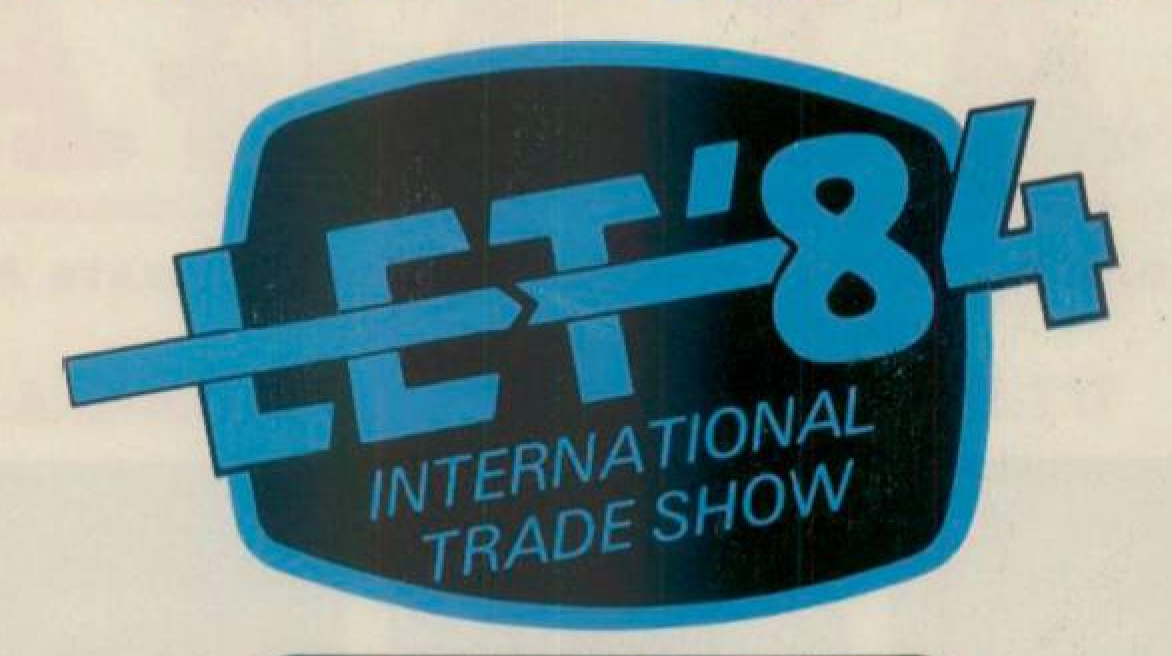
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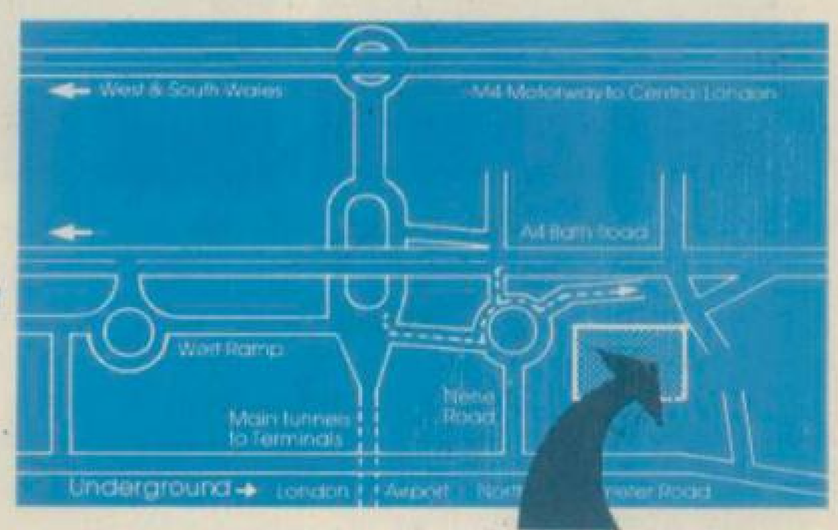
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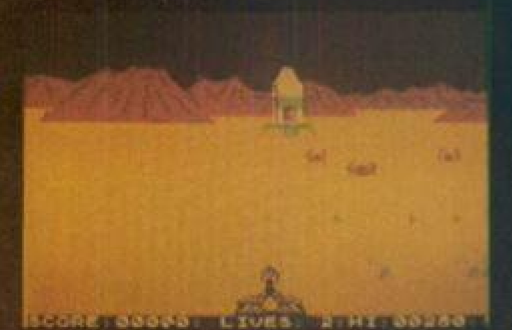
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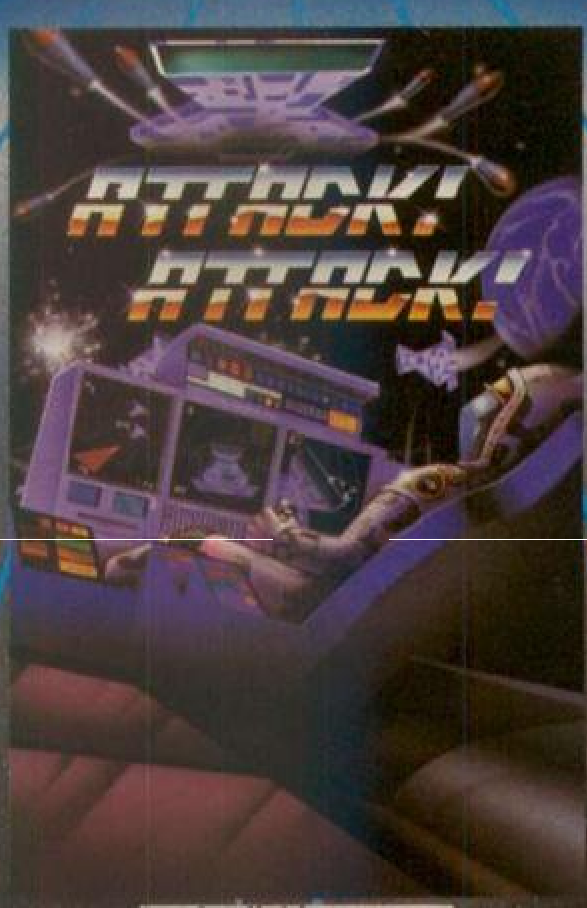
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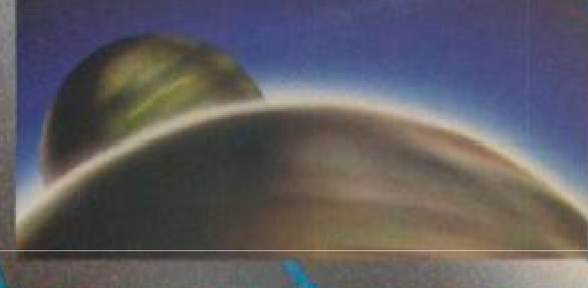


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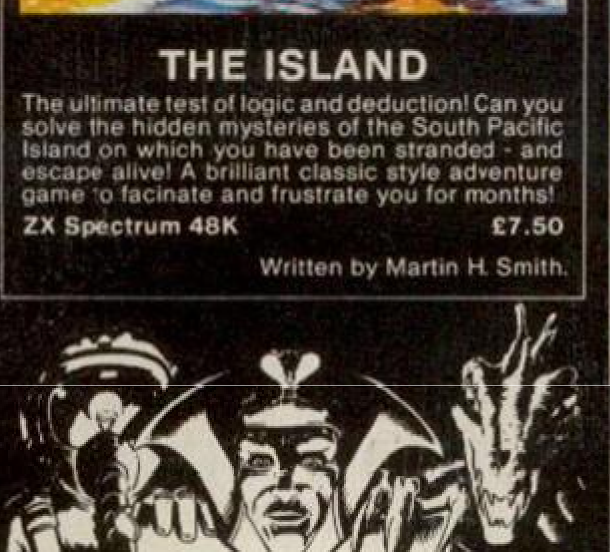


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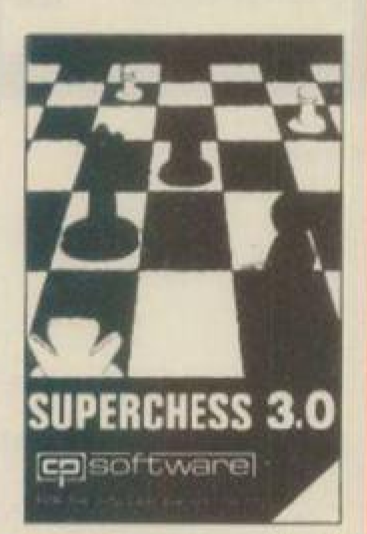
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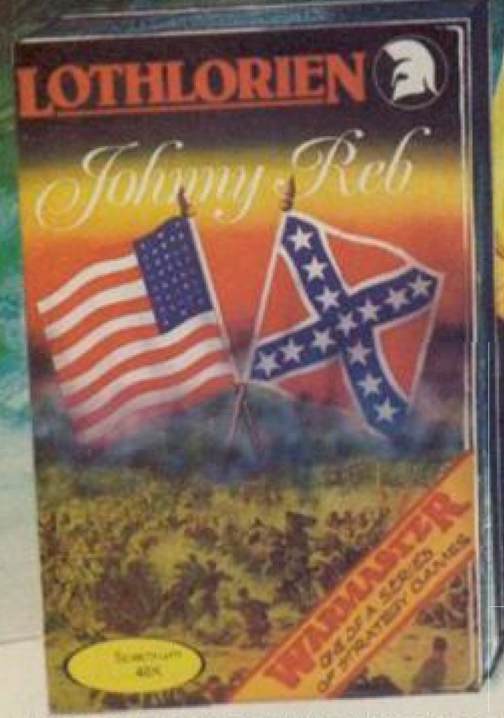
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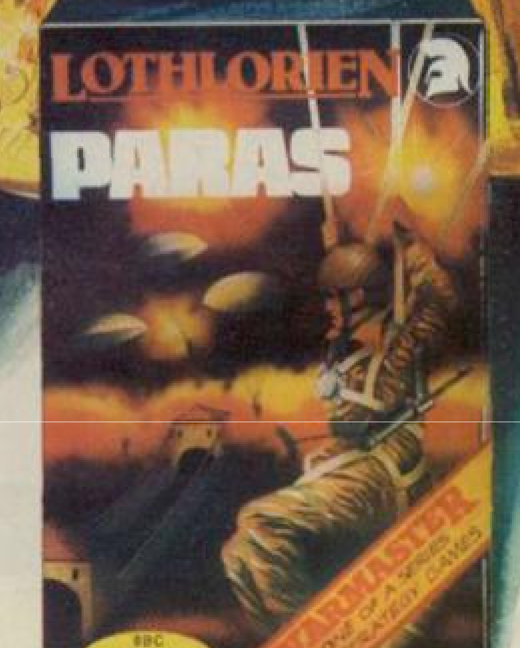
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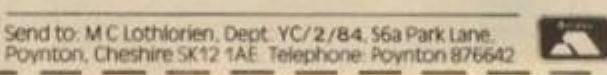
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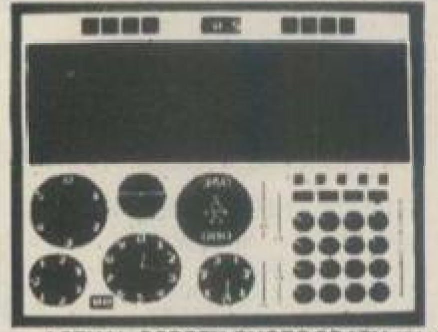
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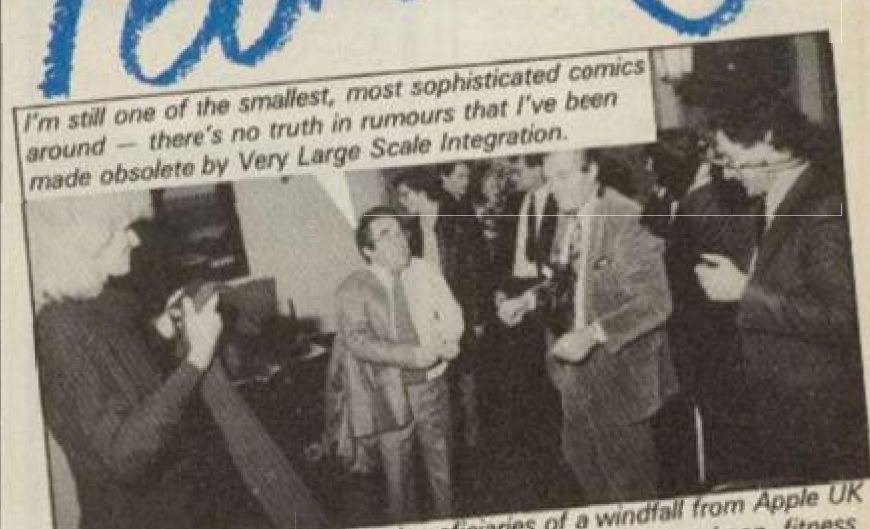
Local, national and international micro events are updated here. To publicise your event, phone Paul Bond on 01-661 3472.

Acorn Education Show

In a month of pretty exclusive exhibitions, here's one for teacher. It is by invitation only, but inside Central Hall Westminster between January 25-27, there will be over 60 companies dealing in Acorn-related services and peripherals, with an educational bias. The show is organised by Computer Market Place Exhibitions Ltd, who can be contacted on 01-930 1612. Apparently Sinclair will be doing something along the same lines in March.

Computer Seminar and Exhibition

Aimed at learned societies, trade associations and clubs who want to learn about using micros for membership records, word processing and financial packages. There will be some discussion of minicomputers. The 14th of February is primarily for learned societies and professional institutions, the 15th is dedicated to trade associations and clubs. It will be held at the International Press Centre. Contact 01-839 4901.



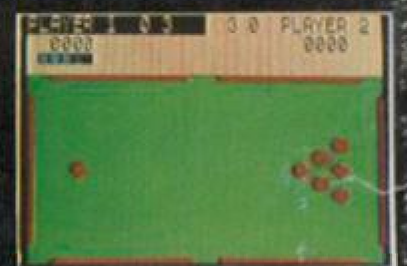
Three charities were recently beneficiaries of a windfall from Apple UK Computers — and at the company's biennial charity luncheon, fitness expert Diane Moran, the Green Goddess, prepares to put comedian Ronnie Corbett through his paces.

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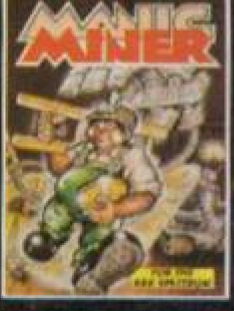
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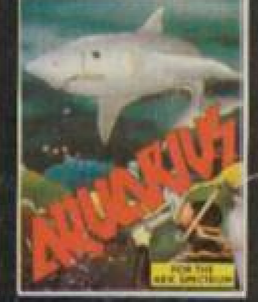
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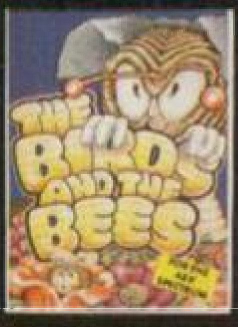
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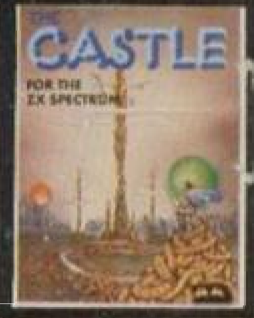
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